THE FOUNDRY

for July

Gen'l Johnson, PLEASE!

BUSINESS soon will be better, General, and we join no issue on the point of whether it will be because of, or in spite of NRA. When the time comes that foundry operations approach a fair normal, there will be an actual shortage of manpower in this industry. All four main branches of the jobbing foundry industry, gray iron, malleable, steel and nonferrous, have subscribed to codes and they with the manufacturing lines operating foundry departments, practically without exception have cooperated splendidly in fulfilling their part in code construction and administration. Regulations as to restricting hours and increasing wage rates have been accepted valiantly, in the face of impoverished treasuries, depressed sales prices and lowered demand for castings. Meanwhile other governmental agencies in many centers have supplied direct competition for a narrowing pool of labor, notably common labor. The attractions of CWA and FERA projects with gaudy pay for indifferent effort, offering a continuity comparable with that available in foundry lines under part time operation, have directly affected the foundry labor supply and a shortage is at hand. This will become more noticeable as conditions improve.

The limitation of child labor never has been aimed at the foundry industry. Foundry work is man's work.

Now comes a new agency that strikes at the industry and indeed at the future opportunity of all who would engage in this endeavor. An innocuous little clause in many codes calls for the employment of no one between 16 and 18 years of age at any occupation that is "hazardous." An NRA agency of uncertain personnel and ancestry has submitted a list of occupations which it designates as "hazardous" under which is listed almost any process or practice that might be encountered in any foundry—or dairy for that matter. The result of the application of such a list would effectively prohibit the employment of anyone under 18, would dry up the available supply of young men for training and would effectively prevent any young man from having an opportunity to embark on this line of employment. Further, the list designates health hazards in general terms that stigmatize an entire industry, may provide ammunition for lawsuits and arrogates to these framers of the hazards list a knowledge which they do not possess. Apparently the only hazard they have not included is remaining in bed, and that, according to Mark Twain is most entitled to consideration, since more people die there than in any other place. Please, General, foundrymen are humane and guard the safety of their employes. Let this committee charged with framing hazards lists, if such indeed are required, council with the industry or stick to more familiar ground—buttonhole finishing, perhaps.

Misguided MANAGEMENT

ADVOCATES of replacing castings with welded structures seem to find the going just a little more difficult. With the foundry industry developing new fields for its product, and reclaiming certain work which was lost for a while to other forms of fabrication, steel companies in some instances are going to extremes to find new markets. A recent news item tells of one company producing rolled steel which has isued an order that all requisitions from its purchasing department for machinery and machine parts stipulate that, whenever possible, welded rolled steel must be used instead of castings. This short sighted policy disregards factors of economy and service to further selfish interest. Experience of the machinery manufacturer, and the availability of castings to meet certain requirements which cannot be met with other products, such as the ability to dampen vibration, mean nothing to a misguided management which sees the possibility of a few dollars profit. This type of reciprocity may prove costly when the small profit is balanced against service and life of the machine. The price of poor judgment falls on the buyer of such a product.

Fig. 1—The well equipped pattern department is large and well lighted with natural light

Building Machine Tool Patterns

Foundry and machine shop executives co-operate with designing engineers

By HERMAN EWIG
Cincinnati Milling Machine Co.
Cincinnati Grinders Inc.

FOR many years the Cincinnati Milling Machine Co., Cincinnati, has operated a foundry and pattern shop for the manufacture of uniform, high quality castings required for its product. The company believes that this subsidiary operation has assisted greatly in maintaining a high standard in quality of product and advancement of design in the machine tool industry.

Building of pattern equipment is the first step in the production of milling and grinding machines, and upon the foundry rests the responsibility for accuracy, appearance and quality of the castings produced. This requires that a maximum amount of study and thought be given to the problems of foundry practice and machine shop procedure before the pattern equipment is built. In the pattern must be embodied the accumulated knowledge of years of experience in building various types of patterns for machine tool castings.

The pattern shop is located in a building adjacent to the foundry and lying between the foundry and machine shop. This is an ideal location, as the pattern shop is situated in close proximity to the engineering department, machine shop and the foundry, so that the engineers, machine shop and foundry executives readily have access to that department of the plant. Thus they can be instrumental in obtaining the best results.

The pattern shop, illustrated in Fig. 1, is large,

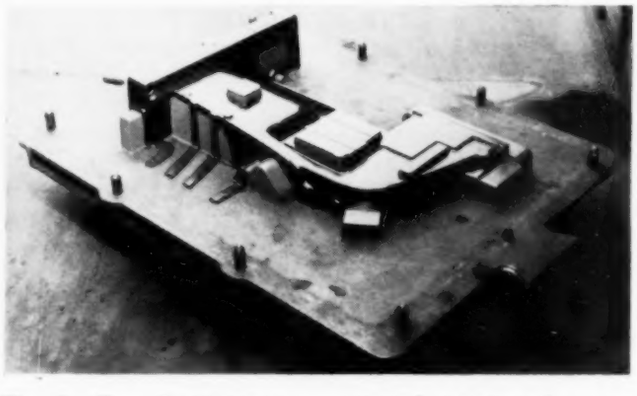


Fig. 2—Class A patterns are mounted permanently on a pair of wood boards or standard steel plates

roomy, and well lighted with natural light. It is well equipped with the necessary wood and metal pattern-making machinery. Provision is made at one end of the building for storing sizable quantities of pattern lumber of all grades so that the lumber may come to equilibrium with pattern shop atmospheric conditions before being worked. This prevents lumber expansion and contraction while patterns are being built and results in a more accurately finished product. The main portion of the lumber supply is kept in the storage building until needed in the pattern shop rack.

The planning of pattern equipment begins long before the drawing for a new designed casting has been completed. Foundry and machine shop executives are in constant touch with the engineering department and are called in consultation on the design of each new major part, so that, upon completion, the design will be satisfactory not only to the foundry but to the shop as well.

Facilitates Work in Shops

To assist the foundry, designs are selected to eliminate as far as possible irregular pattern parting lines, complicated pattern and core box construction, abrupt changes in metal section, sharp interior corners, small fillets, knife edges and complicated mold and coremaking requirements. Thus, when a pattern drawing is ready for the pattern shop, the main features for making that particular pattern already have been outlined clearly. The foundry will benefit from the elimination of troublesome conditions which might have been built into the pattern and caused unsatisfactory castings.

A pattern can be built to meet any one of four different types of construction specifications. Class *A* patterns, the highest grade, are for long-lived standard parts and will be used to make many castings before retirement. The least expensive, Class *D* patterns, are for special parts which, as far as is known at time of construction, will never be reordered. Class *B* and *C* patterns are intermediate grades called for as the occasion warrants. The type of pattern desired is specified by the engineering department and the pattern print is so marked.

After the print is received by the pattern shop, a full-sized layout is made with a shrink rule and the foundry and pattern shop supervision together work out the details of the best method of parting, number of core boxes, where the casting is to be gated and risered, etc., and incorporate the features which will make it conform to the best foundry practice as dictated by previous experience.

Decides Construction Methods

The pattern shop supervision now has the core prints, core box partings, parting line of pattern, etc. drawn on full size layout of the proposed pattern. The best method of construction of the pattern and coreboxes, according to the specification class it must fulfill, is now studied. For example, Class *A* pattern equipment must be built to be mounted for machine ramming and must be constructed strong enough to stand repeated runs on jolt machines. This means that large Class *A* patterns are built upon a rigid framework, glued and screwed together. The exterior lagging has the grain of the wood perpendicular to parting line and is glued and screwed to the framework. Loose pieces are made either of hardwood or metal. Fillets and rounds are carved out of solid wood and all projections of the pattern requiring extreme accuracy in casting reproduction are made of hardwood, the balance of the pattern being first quality white pattern pine.

Large corebox equipment of Class *A* construction is built for jolt machine use and fillets are carved from solid wood, (*Please turn to page* 41)

Fig. 3—Pattern storage facilities are well provided for in a fireproof building of brick and concrete construction

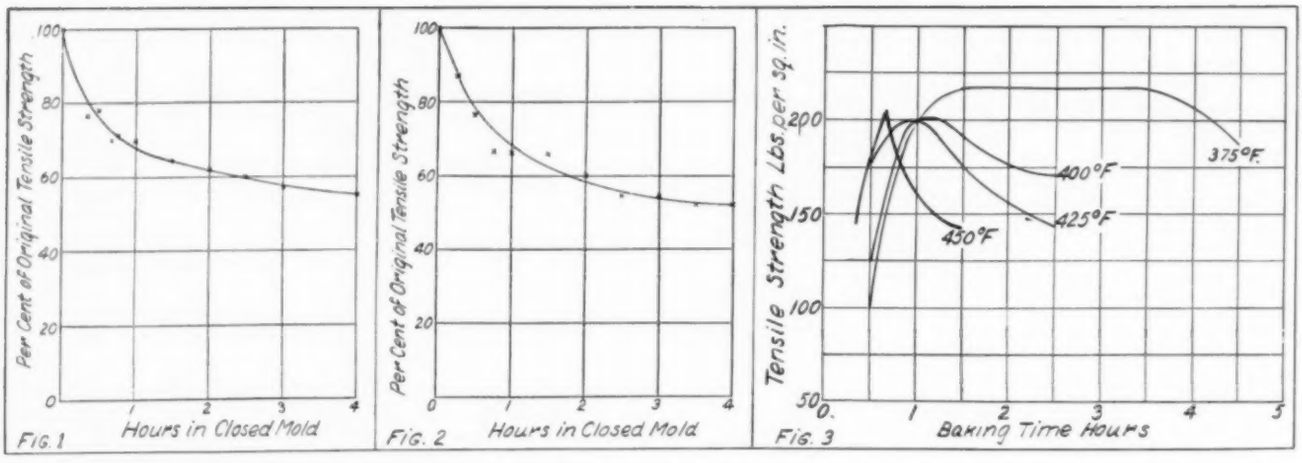


Fig. 1—Decrease in tensile strength through linseed oil cores standing in closed mold. Fig. 2—Same test with soy bean oil cores. Fig. 3—Effect of time and temperature on baking strength of linseed oil cores

Humidity Affects Core Strength

Series of experiments indicates that core strength is reduced by humidity in molds

By F. G. SEFING and M. F. SURLS

Michigan State College, East Lansing, Mich.

RECENT investigation conducted at the Michigan Engineering Experiment station on the strength and other properties of cores disclosed several interesting features particularly those affecting the strength of cores bonded with an oxidizing oil. Parallel experiments were conducted with raw linseed oil and raw soy bean oil as binding agents for cores.

All core mixtures were made in the proportions of 100 parts sand, 1 part oil and 1 part water by weight. The cores were baked for the time and at the temperatures indicated in the various accompanying tables. American Foundrymen's association standard methods for preparation and testing were used in all tests with the exception of those on large cores where certain modifications were necessary.

To study the effect of a humid atmosphere on the strength, a number of cores bonded with each oil were stored in a room with controlled

Table I

Atmospheric Effect on Soy Bean Oil Cores

Total time after removing from oven hours	Time in humid atmosphere hours	Time in sand testing room, after removing from humid atmosphere	Relative humidity in humid room per cent	Relative humidity in sand testing room per cent	Tensile strength pounds per square inch
2	....	....	..	22	173.2
16.5	14.5	0	80 approx.	25	113.6
25.5	14.5	9	80	20	129.6
48.5	23.5	23.0	94	12	142.8
48.5	46.5	0	..	..	87.6
73.0	46.5	24.5	..	17	134.4
97.0	46.5	48.5	..	..	116.4
97.0					109.2

Put in core oven and heated to 220 degrees F. for 20 min. Cores baked 1½ hours at 400 degrees Fahr.

Table II

Atmospheric Effect on Linseed Oil Cores

Total time after removing from oven hours	Time in humid atmosphere hours	Time in sand testing room, after removing from humid atmosphere	Relative humidity in humid room per cent	Relative humidity in sand testing room per cent	Tensile strength pounds per square inch
1	....	....	....	22	178.4
15.5	14.5	0	80 approx.	..	106.8
24.5	14.5	9		20	150.8
47.5	23.5	23	80	12	152.0
47.5	46.5	0	..	..	78.8
72.0	46.5	24.5	..	17	128.8
96.0	46.5	48.5	..	..	134.0
96.0					126.8

Put in core oven and heated at 220 degrees Fahr. for 20 mins. Cores baked 1¼ hours at 400 degrees Fahr.

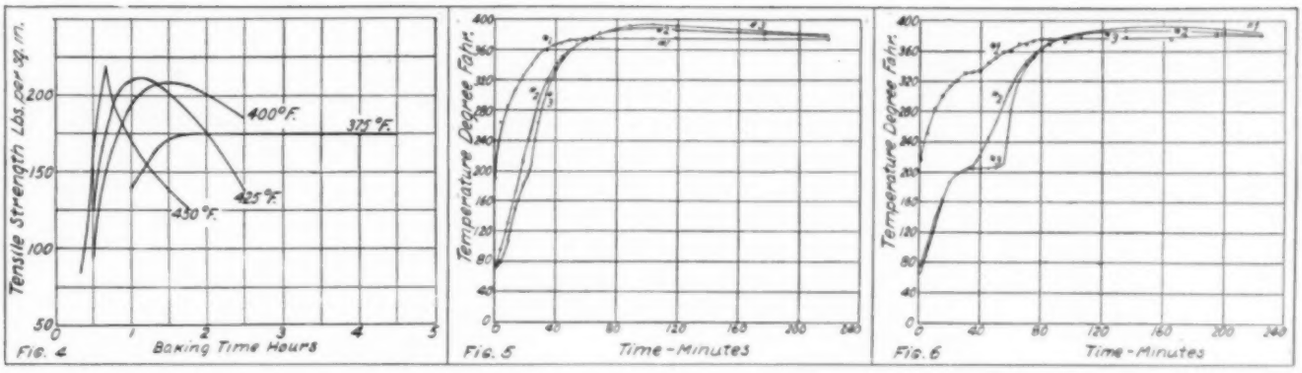


Fig. 4—Same as Fig. 3 for soy bean oil cores. Fig. 5—Temperature characteristics of larger cores during baking, linseed oil with 1 per cent water added. No. 1, at surface of 4-inch cylinder; No. 2, 1-inch from surface; No. 3, at center. Fig. 6—Same as Fig. 5, linseed oil with 6 per cent water added

humidity. The cores were removed from this room at various time intervals and some were tested immediately, while others were allowed to stand for a time in a less humid atmosphere before testing. The results are shown in Tables I & II and show that the highly humid atmosphere caused a marked decrease in strength. Allowing the cores to stand in a relatively dry atmosphere after they were removed from the humid room caused a partial recovery of strength, Redrying the cores for 20 minutes at a temperature of 220 degrees Fahr., did not show any marked improvement in strength.

Some further indications of the effects of humidity on core strength are shown in Table III, a considerable variation over a period of 3 days when there was a considerable fluctuation in the relative humidity. The various strengths noted over a period of 8 days are illustrated in Table IV indicat- (*Please turn to page* 42)

Table III

Effect of Atmosphere on Core Strength

Linseed Oil			Soy Bean Oil		
Time after baking hours	Tensile strength pounds/inches²	Relative humidity per cent	Time after baking hours	Tensile strength pounds/inches²	Relative humidity per cent
2	138.0	50	2	138.8	49
4	142.4	49	19.5	145.2	48
21.5	139.2	48	28.0	130.0	69
30	112.8	69	43.5	124.8	50
45.5	135.2	50	52.0	131.2	50
54	141.6	50	68.0	140.4	30

Linseed baked 1¼ hours at 400 degrees Fahr.
Soy bean baked 1½ hours at 400 degrees Fahr.

Table IV

Ordinary Atmospheric Effect On Tensile Strength

Linseed Oil		Soy Bean Oil	
Time after removing from oven	Tensile strength pounds/inches²	Time after removing from oven	Tensile strength pounds/inches²
1 hour	168.8	1 hour	141.6
1/3 day	151.2	¼ day	129.2
1 day	170.0	¾ day	146.4
1½ days	160.0	1 day	133.6
2 days	171.6	2 days	146.0
3 days	164.8	3 days	136.0
4 days	177.2	4 days	126.4
6 days	153.2	6 days	128.4
8 days	162.8	8 days	134.8

Linseed baked 1¼ hours at 400 degrees Fahr.
Soy bean baked 1½ hours at 400 degrees Fahr.

Table V

Cores Lose Strength in Green Sand Molds

	Linseed Oil Cores		Soy Bean Oil Cores	
Time in mold hours	Tensile strength pounds/inches²	Per cent of original strength	Tensile strength pounds/inches²	Per cent of original strength
0	151.7	100	135.5	100
1/6	129.7	85.5		
1/4			117	87
1/3	115.6	76.3		
1/2	118.6	78.0	103.7	76.5
2/3	105.5	69.6		
3/4	107.6	71	90.4	66.7
1	105.8	69.7	89.7	66.3
1½	98	64.6	89.3	66
2	94	62.0	82.4	60.7
2½	91.5	60.3	73.9	54.5
3	86.5	57.0	73.9	54.5
3½	86.0	55.7	70.5	52
4			70.4	52

Linseed oil baked 1¼ hours at 400 degrees Fahr.
Soy bean oil baked 1½ hours at 400 degrees Fahr.

Table VI

Effect of Core Size on Baking Characteristics

Baking time hours	Type of core plate	Tensile strength pounds/inches² top section	Tensile strength pounds/inches² center section	Tensile strength pounds/inches² adjacent to core plate
1½	solid	121.2	106.4	65.2
1½	drilled	147.2	142.0	107.2
2	solid	128.0	138.4	118.1
2	drilled	135.2	148.8	154.4
2½	solid	118.4	127.2	163.2
2½	drilled	144.4	134.0	169.6

Sand bonded with soy bean oil.

Table VII

Effect of Core Size on Baking Characteristics

Baking time hours	Type of core plate	Tensile strength pounds/inch² top section	Tensile strength pounds/inch² center section	Tensile strength pounds/inch² adjacent to core plate
1¼	solid	166	145	124.8
1¼	perforated	151.6	160.0	140.8
1½	solid	157.0	154.1	135.7
1½	perforated	184.4	166.4	198.8
2	solid	145.6	153.2	178.4
2	perforated	151.6	156.4	174.8

Bonded with linseed oil.

Report on Research Projects

A. S. T. M. committees present interesting data at annual meeting in Atlantic City

ADVANCEMENT and progress in castings manufacture always is reflected accurately in the call for new standards and tests from the American Society for Testing Materials. The 37th annual convention of the society held in Atlantic City, N. J., June 25-29 gave further evidence of this fact. In the papers and discussions, but more extensively in the committee sessions, the call for new specifications to meet higher qualities of cast products, was most clearly evident.

During the week, ten committee conferences dealing directly with the output of the foundry industry and thirteen with questions of metals, testing and practice relating to laboratory or shop procedure, had a direct bearing upon foundry matters. The report of committee A-3 on cast iron, presented at the Wednesday morning session, is indicative of the thought and study inspired by the newer accomplishments of the industry. The committee recommended at this time only one revision in tentative standards for cast iron and this was in relation to culvert pipe. However, a report of the special subcommittee on test bars gives indication of probable revisions in the general specifications for gray iron, A48-32T.

W. H. Bassett
New President of the American Society for Testing Materials

R. S. MacPherran, Allis Chalmers Mfg. Co., Milwaukee, chairman of the subcommittee, outlined briefly tests that are being made at the universities of Illinois, and Michigan in co-operation with various manufacturing establishments, including Deere & Co., and Frank Foundries Corp., Moline, Ill., Lunkenheimer Co., Cincinnati, Nordberg Mfg. Co. and Allis Chalmers Mfg. Co., Milwaukee. This subcommittee is securing information on the following subjects:

1—Methods of making test bars.

2—Correlation of test bar sizes and controlling sections as shown in the tentative specifications for gray iron castings, previously noted.

3—Determination of deflection values in transverse loads on typical cast iron bars.

4—Comparison of tensile strength tests on broken halves of transverse test bars and on separately cast tension bars.

These tests are intended to check provisions of the specifications. Some work has been done on methods of making the bars, including horizontally poured green sand and vertically cast dry sand cores. This work is incomplete. A study of cooling rate in relation to section is under way. Complete data including chemical analyses is being accumulated on all of these test specimens.

The thirty-seventh meeting of the A. S. T. M. marked a change in trend from the downward sweep of the depression. The society reports an increase in new members. Attendance of over 700 bettered the Chicago meeting of 1933 and equalled the 1932 attendance figure.

T. R. Lawson, Rensselaer Polytechnic institute, Troy, N. Y., president of the American Society for Testing Materials, at the opening session presented in retrospect the work and accomplishments of the organization during the year. He stressed the value of specification advancement, the stimulus of committee activity and the effectiveness of the symposium on corrosion conducted during the spring committee meetings held in Washington in March.

Papers and publications carrying results of work of the society constitute a major contribution to all industrial and technical progress. According to C. L. Warwick, secretary, the society issued through its headquarters in Philadelphia more than 5900 pages of printed material covering proceedings, standards and tentative standards, symposiums on technical subjects and joint publications with other societies, during the calendar year of 1933. The secretary reported the tender of the services of the A. S. T. M. to both the National Recovery and the

Public Works administrations. Copies of the A. S. T. M. standards and specifications were provided the latter for the use of each state engineer of public works for use in the work of the recovery program.

Development of codes under NRA has raised the question of standards of quality of materials in many industries. Scattered reference to standards provisions in various codes include reference to A. S. T. M. specifications and the society has directed attention to the fact that its procedure provides for the combined judgment of producers and consumers in formulating more than 700 standards now available for a wide group of industries.

Research projects, fostered and furthered by the society cover a wide range of industrial problems, according to the report of H. F. Moore, University of Illinois, Urbana, Ill., chairman of the committee on research. One project of particular interest to the metal industries is a joint project on the investigation of pig iron, under a committee made up of representatives of the A. S. T. M., American Foundrymens' association, Gray Iron institute, Malleable Iron Research institute and American Institute of Mining and Metallurgical Engineers.

The question of standards which under the practice of the society has involved the preparation of both specifications and testing methods was reviewed by Cloyd M. Chapman, consulting engineer, New York, who mentioned the 174 changes in standards during the past year. Of this number 34 represent new tentative, 27 tentative revisions and 39 advanced to standard embracing some materials or commodities in practically every line of engineering and construction.

Hardness Testing Presents Difficulties

Hardness testing of thin specimens by the rockwell method presents difficulties, according to R. L. Kenyon, American Rolling Mills, Middletown, O., who offered some interesting experimental results in a paper at the opening technical session. Hardness tests were made on thin specimens of low-carbon *killed* steel. The variables of thickness of specimen, smoothness of surface, lubrication of surface and ball, flatness and hardness of anvil and roughness of ball were simplified through the use of a special technique which left only the thickness as the unknown quantity. At the start, the area surrounding the impression left by the rockwell ball showed a ridge and as the thickness was decreased, this ridge disappeared and a depression occurred. Similarly, at a certain point, a bulge appeared on the surface and the appearance of this bulge is evidence that the rockwell reading is questionable. Side flow caused lower readings, anvil effect higher readings, and punching through caused lower results. Decreasing the load on the test apparatus made it possible to obtain reliable readings on thinner pieces.

An outstanding contribution to the metallurgy of steel is represented in the report of the committee on the investigation of the effect of phosphorus and sulphur on steel, presented by H. S. Rawdon, U. S. bureau of standards at the Wednesday morning session. This investigation which has been under way for a number of years applies to various types of commonly used structural steels, rivets, castings, etc. The present report covers the effect of phosphorus on low-carbon steel for pipe and of sulphur on forging steel.

A report of the committee on magnetic properties, presented by Thomas Spooner, Westinghouse Research laboratories, East Pittsburgh, Pa., offered nomenclature and tentative definitions of units, symbols and terms which were passed to letter ballot of the society. The report of committee A-1 on steel, one of the largest and most important of the A. S. T. M. committees, charged with the responsibility for 63 standard and 20 tentative standard specifications was presented by the chairman, H. H. Morgan, Robert W. Hunt Co., Chicago.

Apply Statistics to Metallurgy

Application of statistical methods to the metallurgical problems encountered in a steel plant formed the subject of a paper by W. C. Chancellor, National Tube Works, Lorain, O. The limits of variation to be expected in the average and standard deviation, developed mathematically, form the basis for control charts covering various steps in steel production. A set of charts developed for percentage of FeO in open-hearth finishing slags was built up from a study of 416 individual heats, grouped in 104 sets of four each. From this basis, the average and standard deviation of each sample of four was calculated. Methods are suggested for determining whether variation is due to a constant system of chance causes alone or in part to correctible causes. The statistical methods are useful in identifying the latter class of cause.

Report of the joint research committee on effect of temperature on the properties of metals was submitted by H. J. French. Its activities during the past year include work on slight revisions of the tentative test codes for short time high temperature, tensile testing and for long time or *creep* testing, indicating that the committee takes the attitude that such codes require constant improvement and clarification on the basis of new information and of experience with the use of codes.

A major activity of the committee was the extensive study it sponsored on tensile, fatigue and creep properties of 18 and 8 stainless steel of two carbon contents, each composition being studied as split heats, part of each heat being made into castings and part in wrought material. This work will be reported in detail in the July issue of the *Transactions* of the American Society of Mechanical Engineers.

Additional projects (*Please turn to page* 44)

Studies Cast Red Brass

Casting data collected to establish basic classification of nonferrous ingot metals

By C. M. SAEGER JR.
Bureau of Standards, Washington

THE second phase of the investigation, which was described in the first section of this article in the June issue of THE FOUNDRY, dealt with the effect of specific amounts of impurities on the physical properties of a red brass analyzing 85 per cent copper, 5 per cent tin, 5 per cent lead and 5 per cent zinc. In this part of the study a reduction was made in the number of types of test bars. Those used were the immersed-crucible bar, the end-gate bar, both *cast-to-size* and *machined-to-size*, the fin-gate bar with ¼-inch web, and the *no-side-chill* bar from the cast ingot. These bars were cast from heats of remelted metal to which had been added from 0.025 to 0.10 per cent sulphur or 0.10 to 0.60 per cent of iron. Effects of sulphur and iron on the physical properties were determined by comparison with those of remelted metal. The values for remelted metal at pouring temperatures of 1065 and 1230 degrees Cent. were obtained by averaging the values previously given for 1040 and 1095 degrees Cent. and for 1205 and 1260 degrees Cent. respectively as shown in accompanying chart.

TENSILE STRENGTH — Results in Fig. 16 indicate a slight decrease in tensile strength as the sulphur content was increased. Comparison of the values for the four types of bars with reference to "the minimum tensile strength expected for this alloy," as presented in the appendix to tentative specifications for copper-base alloys in ingot form for sand casting (A.S.T.M. Designation: B30-32T), *Proceedings*, American Society for Testing Materials, Vol. 32, Part I, p. 677, 1932, is indicated by a broken line in Figs. 16 and 17, and shows that most of the bars which had tensile strengths much below this *minimum* were cast at 1205 and 1260 degrees Cent. From these results it appears that the pouring temperature had more influence on the tensile strength than had the sulphur content.

The results in Fig. 17 indicate that the addition of iron tended to increase the tensile strength, especially of the sand-cast bars. This effect may be caused by the iron acting as a deoxidizer. D. Hanson and G. W. Ford, in "Investigation of the Effects of Impurities on Copper, Part II," *Journal Institute of Metals*, Vol. 32, p. 335, 1924 found that in an oxidizing atmosphere iron acts as a deoxidizer for copper. H. C. Dews in *The Metallurgy of Bronze*, has reported that

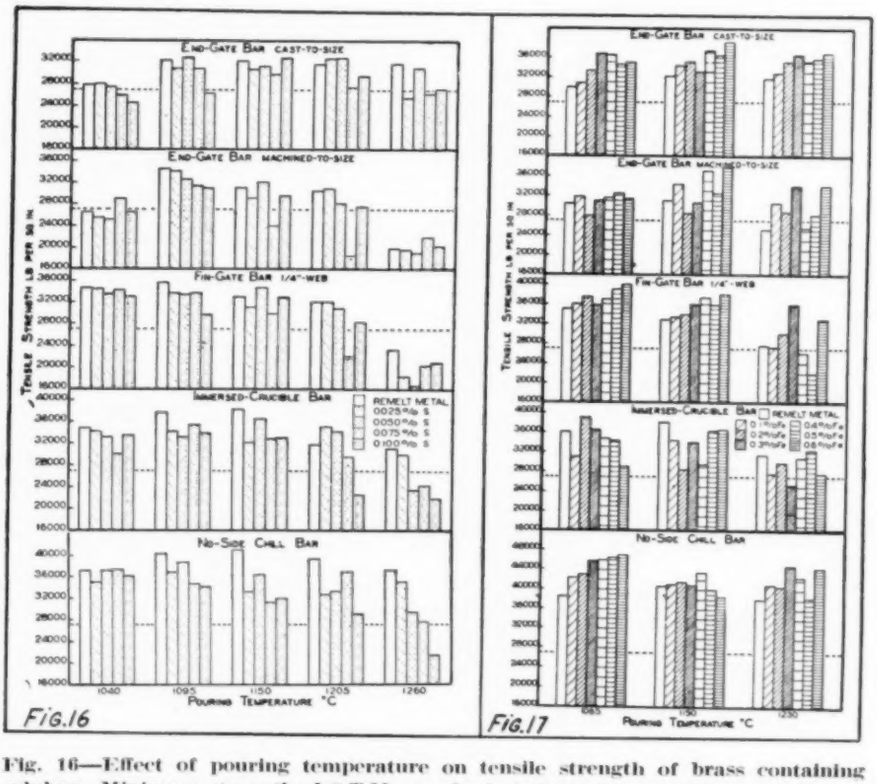


Fig. 16—Effect of pouring temperature on tensile strength of brass containing sulphur. Minimum strength, A.S.T.M. standards indicated by broken line. Fig. 17—Effect of pouring temperature on tensile strength of brass containing iron. Minimum strength indicated by broken line

this same reaction occurs in the case of bronzes.

BRINELL HARDNESS—The results of the brinell hardness determinations are shown in Figs. 18 and 19. In the American Society for Testing Materials specification for this alloy as shown in the appendix to the A.S.T.M. tentative standard, previously mentioned, a brinell hardness number of 50 to 60 is required. In Figs. 18 and 19 the minimum value of 50 is indicated by a broken line. In the curves showing the effects of sulphur, it may be noted that many of the bars containing sulphur and poured at 1205 or 1260 degrees Cent. have hardness numbers below 50.

The addition of iron appeared to raise the brinell hardness, and the values were well above the required minimum value of 50, with the exception of some of the sand-cast bars poured at 1230 degrees Cent.

ELECTRICAL RESISTIVITY—The data in Figs. 20 and 21 show that sulphur has little effect on the resistivity of the test bars poured at or below 1150 degrees Cent. Higher resistivities were obtained, however, on the bars poured at 1205 and 1260 degrees Cent. This increase in resistivity apparently is caused by the increase in the pouring temperatures rather than by the increase in the sulphur content.

A marked increase in electrical resistivity was found for all test bars containing 0.1 per cent iron, but no significant further increase was found for iron contents up to 0.6 per cent.

DENSITY—The data in Figs. 22 and 23, show that the density of this alloy was affected to a greater extent by the pouring temperature than by changes in the content of sulphur or iron.

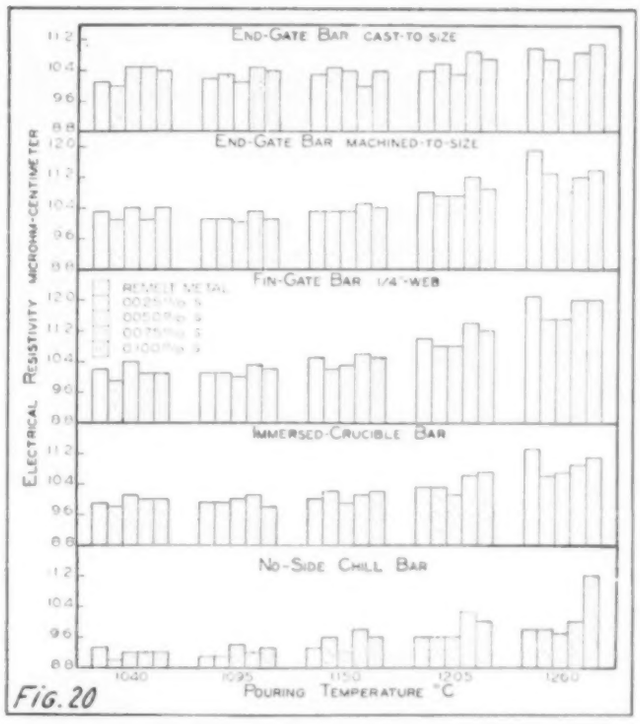


Fig. 20—Effect of pouring temperature on electrical resistivity of red brass containing sulphur

RUNNING PROPERTIES—The data in Figs. 24 and 25 show that sulphur somewhat increased the running quality of the alloy at all pouring temperatures and especially at the higher temperature. The alloy poured at the higher temperatures (1150 and 1230 degrees Cent.) showed slightly increased running properties with an increase in iron content up to 0.3 per cent, but above this iron content the running properties decreased irrespective of the pouring temperature.

SHRINKAGE — The data in Figs. 26 and 27 show that there was an increase in the specific volume with increase of sulphur content at all pouring temperatures. The effect of iron on the specific volume was not so definite or so uniform as that of sulphur. The shrinkage of the alloy in the solid state was not influenced to any

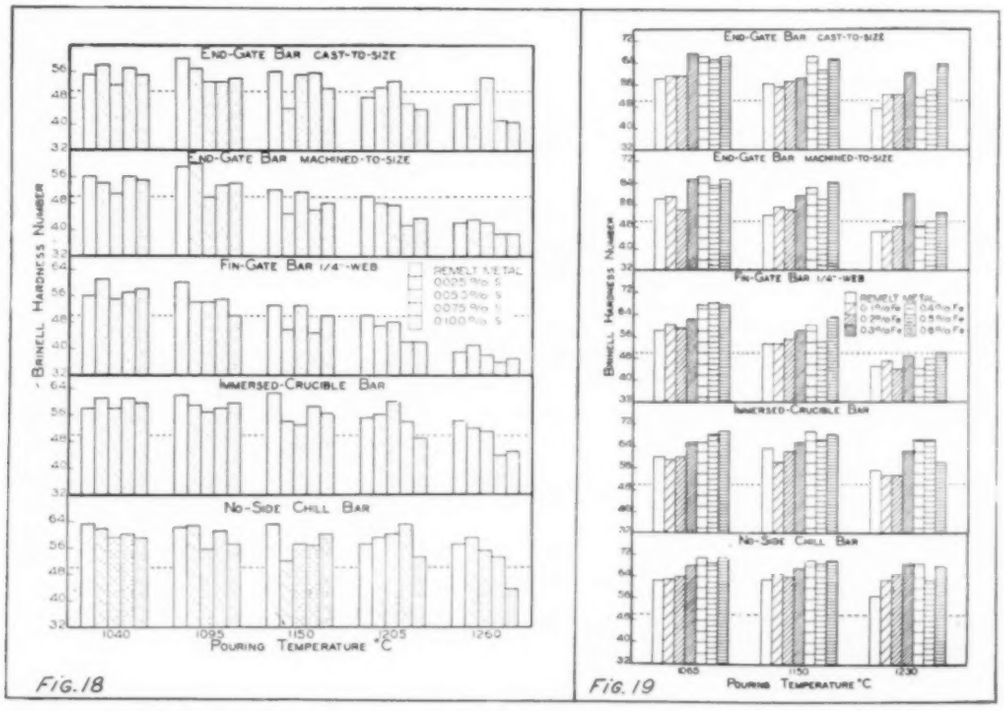


Fig. 18—Effect of pouring temperature on brinell hardness of red brass containing sulphur. Fig. 19—Effect of pouring temperature on brinell hardness of red brass containing iron. Minimum brinell for alloy, A.S.T.M. specifications, indicated by broken line in both charts

significant extent by the additions of either sulphur or iron.

Neither sulphur nor iron appreciably influenced either the solidus or the liquidus temperature of this alloy. Although the sulphur or iron produced a slight change in the specific volume of the liquid and solid metal, the slopes of the specific volume-temperature curves are the same as those reported for virgin and remelted metal. Hence, there was no significant change in the shrinkage.

It is evident from these data that sulphur or iron in the amounts used are not necessarily injurious to the alloy 85-5-5-5 if the pouring temperature is kept below 1205 degrees Cent.

Summarize Principal Findings

In summarizing, the tensile strength, electrical resistivity, hardness and density of cast red brass (copper, 85; tin, 5; zinc, 5; lead 5) were determined on four types of test bars—two sand-cast, a chill ingot and a special bar dipped from the molten metal. The pouring temperature was varied from 1040 to 1260 degrees Cent. Data on the shrinkage and running properties were also obtained. The most important results follow:

1. Properties of test bars made of virgin or of remelted metal of the same nominal composition, cast at the same temperature, were alike.

2. Pouring temperature affected the properties of all the test bars much more than any other factor. In general, the best results for the sand-cast bars were obtained with a pouring temperature below 1205 degrees Cent.

3. These effects of pouring temperature on the physical properties of test bars were the same for alloys containing either sulphur (maximum 0.10 per cent) or iron (maximum 0.6 per cent).

4. Physical properties of test bars poured at 1150 degrees Cent. or below were not affected appreciably by the presence of sulphur up to 0.10 per cent. In bars poured at higher temperatures 0.10 per cent of sulphur adversely affected the properties, particularly of the sand-cast bars. Additions of iron up to 0.6 per cent had similar but much less pronounced effects.

5. Detrimental effects of high pouring temperatures and of impurities were much more pronounced in the sand-cast bars than in the other types. The nonuniform grain structure of the sand-cast bars and the existence in them of a strained condition during cooling probably are related to these effects.

6. Flowing properties increased with the pouring temperature. The presence of sulphur, up to 0.10 per cent, improved the flowing properties, while iron had no consistent influence. Similar statements apply to the shrinkage.

7. A comparison of the results for tensile strength and hardness with the minimum requirements for this alloy in ingot form set forth by the American Society for Testing Materials shows (a) that the end-gate sand-cast bar is unsuitable for low pouring temperatures, (b) that, with this exception, all sand-cast bars of virgin or remelted metal poured at a temperature not exceeding 1205 degrees Cent. easily meet these minimum requirements, and (c) the presence of sulphur up to 0.10 per cent, or of iron up to 0.6 per cent is not objec- (*Please turn to page* 49)

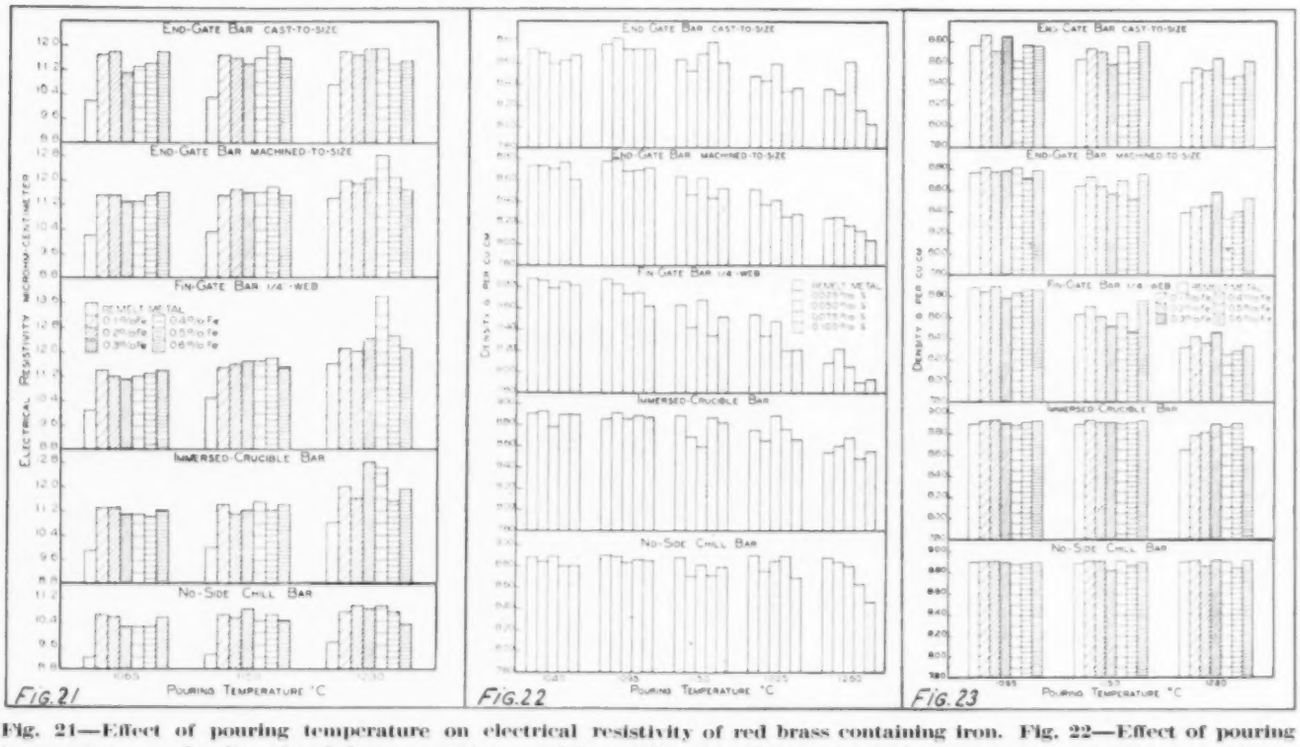


Fig. 21—Effect of pouring temperature on electrical resistivity of red brass containing iron. Fig. 22—Effect of pouring temperature on density of red brass containing sulphur. Fig. 23—Effect of pouring temperature on density of brass containing iron

Anneals Malleable in Small Furnace

Finds economies and reduction in cycle through unit having capacity of 10 tons

By L. J. WISE
Chicago Malleable Castings Co.

SINCE the popular tendency of the day seems to be to junk many established and formerly placidly accepted practices, the changes in the malleable iron annealing process can be said to be decidedly in tune with the times.

Going back to the year 1923 the author, at that time connected with one of the largest producers of malleable castings in the country, recalls the large sluggish annealing ovens with their 18 to 27-inch sidewalls and massive crowns and built-in fire-boxes, with approximately the following annealing cycle:

	Hours
Time to reach soaking temperature	60
Held at soaking temperature	72
Cooling to 1200 (8 degrees per hour)	50
Cooling to handling temperature	24
Total	206

Obviously this meant that the user of malleable castings had to anticipate his requirements considerably in advance of his needs and there was no way by which the foundry could help the customer out of a jam when castings were needed in a great hurry.

Malleable Iron Tonnage Increased

This condition was quite a handicap to the sale of malleable castings and resulted in many parts being made of other materials, where malleable would have been the logical and most economical material to use, barring the time element.

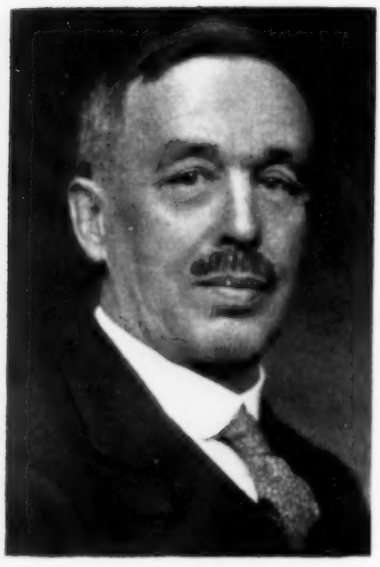
During the next 5 years the tonnage of malleable produced increased simultaneously with the phenomenal growth of the automobile industry. Many plants built more and bigger annealing ovens, the theory being that the larger the tonnage annealed per oven, the lower was the cost of annealing. Increasing the size of the ovens, obviously, did not tend to reduce the annealing time. Several installations of continuous ovens were made, where production was sufficient to warrant it. However, even here, the prime factor was cost reduction, although there was a substantial reduction in time. During that era improved methods of firing were adopted widely, principally pulverized coal and oil. Here again the prime motive, as in the case of the continuous kiln, was cost reduction.

Shortly before the depression set in, the industry was shaken up considerably by the revelation that the annealing time could be reduced 50 per cent or more by the use of electric heat-treating furnaces, accurately controlled and taking advantage of recently developed theory that it was not necessary to cool at an extremely slow rate between the upper temperature and the critical range (1400-1300 degrees Fahr.). However, like anything new, this process was not accepted readily by the industry as a whole for a number of reasons, chiefly the cost of electricity.

The depression brought the period of hand to mouth buying. Foundries that formerly loaded one of their big ovens every day were putting their entire week's production into one oven and the vicious cycle of dissatisfaction started. Buyers could not release orders until the castings were actually needed and the foundry could not run a heat until it had accumulated sufficient orders. Buyers were forced to seek other sources of supply or use other materials if possible.

To meet these con- (*Please turn to page* 54)

Provision has been made for the subsequent installation of a car bottom in the small annealing furnace



H. Winterton
Junior Vice President

Roy Stubbs
President

J. E. Hurst
Senior Vice President

I. B. F. Discusses Brass Castings

American exchange paper attracts attention at annual foundry conference in Manchester

By VINCENT DELPORT

European Manager, The Foundry

INSTITUTE of British Foundrymen held its annual conference in Manchester, June 5 to 8, with an exceptionally large attendance. The organizers of the meeting, the Lancashire branch of the I.B.F., found in Manchester, one of the largest industrial centers of the British Isles, many facilities for holding the convention, which added greatly to the success of the event. The banquet, held at the Midland hotel, the headquarters of the conference, was attended by about 350 people.

During the meeting, the following officers were elected for the year 1934-35: President, Roy Stubbs, Joseph Stubbs, Ltd., Openshaw; senior vice-president, J. E. Hurst, technical director, Bradley & Foster, Ltd., and Sheepbridge Stokes Centrifugal Castings Co., Ltd.; junior vice-president, H. Winterton, Wm. Cumming & Co., Ltd. The meeting also approved the award of the Oliver Stubbs medal to V. C. Faulkner, editor of the *Foundry Trade Journal*, who, apart from the considerable services he has rendered to the institute over a period of years, largely was responsible for the successful materialization of the scheme to establish a university degree in founding. The medal for long and meritorious service was awarded to J. J. McClelland, honorary secretary, Wales and Monmouth branch, for the many years he has devoted in the service and development of the branch.

The conference was opened formally on Wednesday, June 6, with C. E. Williams in the chair. A civic welcome was extended by the Right Honorable the Lord Mayor of Manchester, Alderman Joseph Binns, who was supported by B. Mouat Jones, M. A., principal of the Manchester College of Technology. T. Makemson, secretary of the institute, read a cable of greetings sent by Frank J. Lanahan, president, American Foundrymen's association, which also contained an urgent appeal for representative members of the Institute of British Foundrymen to attend the Fifth International Foundry congress in Philadelphia next October. A telegram of greetings also was received from the Association Technique de Fonderie, of Paris.

C. E. Williams then installed Roy Stubbs as president, and the *(Please turn to page 57)*

Properties Extend Gray Iron Uses

Symposium provides valuable data which should be placed in hands of customers

By W. WORLEY KERLIN
Gray Iron Founder's Society

POSSIBILITIES of extended uses for gray iron castings become more favorable through the revised specification of the American Society for Testing Materials, designated A48-32T, and the authoritative data on the mechanical properties of gray cast iron contained in the *Symposium on Cast Iron* recently published under the joint sponsorship of the A.S.T.M. and the American Foundrymen's association. Some of the newer applications demonstrate that the usefulness of gray cast iron need not be confined to cases where static loads prevail or mass is a requisite, but with proper application of test data in design, dynamic loads may be sustained with safety.

The fundamental test upon which engineering classifications of gray iron now are based is tensile strength. The underlying reason is that designers then may choose the tensile class which they wish their material to show and the critical section in which they wish it to appear and then assign factors of safety of around 1 to 5 for static loads or 1 to 10 for live loads. Gray iron then is placed on an equivalent basis with forgings, pressed metal and structure produced by other methods of fabrication.

Because the internal structure of gray iron is dependent, to a great extent, on amount and distribution of graphite particles, mass plays an important role in the strength of gray iron from section to section. Mass effect is what a customer has in mind when he asks for a *uniform grain* iron. This may be interpreted in the light of the most recent specification published by the A.S.T.M. by referring to the three representative bars recommended. Small variations in tensile strength in the smallest bar of ¾-inch diameter and the largest bar, 2 inches in diameter, indicate irons that are quasi-isotropic and are liable to exhibit uniform properties from lighter to heavier sections. Most foundrymen know that uniform grain is a matter of proper melting conditions, steel content in the mix, and controlled carbon-silicon balance. Surveys show that condition may be produced in class 25 and 30 irons as well as in the higher strength irons of class 40 and 50, so it is a matter of choosing an iron which is feasible commercially for the casting in question.

A test which will give a fair idea of what strength to expect in sections under ⅜-inch thickness as yet has not come into common use, although surveys have been made on those sections. A light gray iron in a highly machinable class seldom will be weaker than 30,000 pounds per square inch in the section in which it is used. This is a point which is not widely known among designers employing cast iron.

Cast Iron Has High Strength

Compression strength of cast iron is known to be superior to structural steel and most other engineering materials so its usefulness in supporting static loads long has been demonstrated. Because its compressive strength runs from 3 to 5 times its tensile strength it is possible for a properly designed gray iron casting to have unsurpassed resistance to loads alternating between tension and compression. This is one of the basic reasons for the high fatigue resistance of gray iron and is one which the founder should not allow the engineer-customer to lose sight of.

This leads to a consideration of the elastic properties of gray iron. Castings in that metal can sustain loads up to 80 per cent of its tensile strength or its compressive strength without deformation of a permanent nature. Testing engineers speak of the ability of gray iron to resist alternating stresses as fatigue resistance and the so-called endurance limit is the yard stick by which this property is measured. The endurance limit is the percentage of the tensile breaking load which a metal will allow to be repeated a hundred million times or more without failure. The endurance limit is proportionately greater than all other structural materials because these other metals begin to deform permanently sooner and this is a preface to failure. It is therefore safe for a designer to use the usual factors of safety for gray iron on an equivalent basis with other materials and the (*Please turn to page* 52)

Gives Alternative Molding Methods

Details of molding and coremaking depend on whether the core is in one or several parts

By R. LOWER

LOAM molds are employed almost exclusively in German foundries for making large castings. A rigid loam mold resists the pressure and weight of the iron more satisfactorily than a sand mold, produces a casting free from swells and strains and provides a secure foundation for heavy cores. Usually the molds are formed in pits in the floor, but exceptions are noted where the molds remain above the floor line encased in a suitable curbing.

As with sand molding, many methods are available in the construction of pattern equipment for any given casting in a loam mold. Local conditions, including available foundry rigging and the personal preference of the man in charge constitute the deciding factors in selecting one method of molding in preference to another. The accompanying illustrations show two methods adopted for molding a blowing engine piston casting 75 inches diameter and with an average metal thickness of 1½ inches. Alike in outward dimensions, the two castings differed slightly from each other in the style of the 16 internal ribs. The small opening *a* in the sectional view Fig. 1 was common to every core section between the ribs and was placed there to form an exit for the gas during the pouring operation, and later for the removal of the core from the casting. In the machining operation suitable plugs were screwed in these openings. In Fig. 2, a sectional view of Fig. 1 at the line *AB*, it will be noted that the central rib *C* is cored through at the rim and at the hub *D* and *D*. The ribs at either side C_1, are cored through the center D_1. This form of alternate rib construction extends throughout the casting. In the casting shown in Fig. 3 the cored openings through the ribs are arranged in a slightly different manner, two openings *D* in rib *C* and three openings *D* in rib C_1. This difference in rib construction was one of the factors responsible for the two coremaking methods adopted for the two castings. For the casting shown in Fig. 2, the core was made in 16 sections and assembled in the mold. For the casting shown in Fig. 3 the core was swept up and handled as a unit.

The two loose ribs *C* and C_1 Fig. 4 were placed alternately in the corebox Fig. 5 to form the 16 cores required in the casting shown in Fig. 2. In actual practice, of course, eight cores were made with rib *C* in place. This rib then was removed from the corebox and replaced by rib C_1 and the second set of eight cores was made with

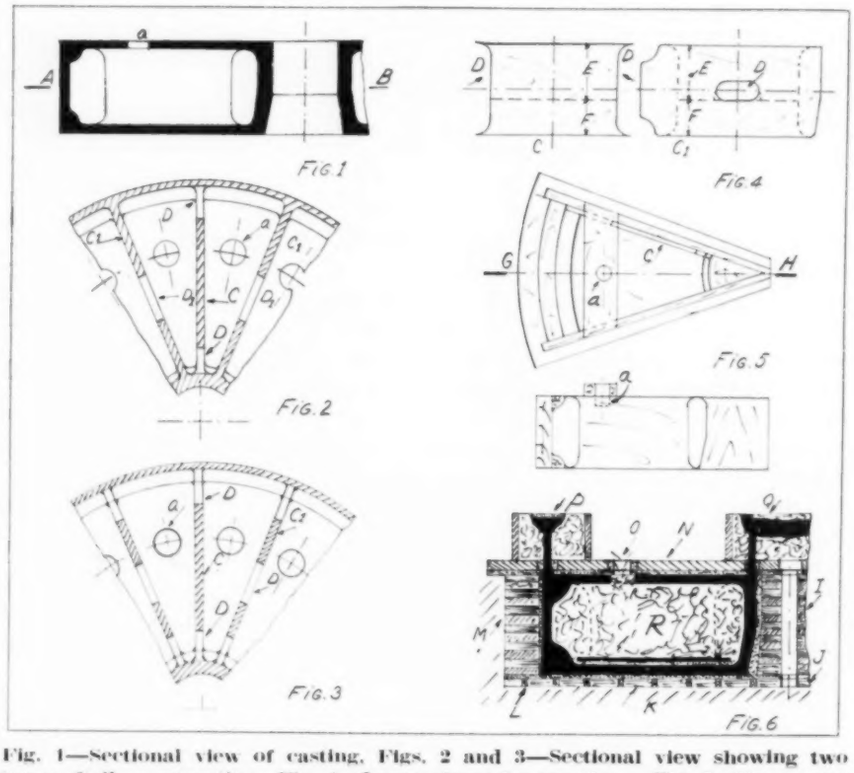


Fig. 1—Sectional view of casting. Figs. 2 and 3—Sectional view showing two types of rib construction. Fig. 4—Loose pieces for core box. Fig. 5—Upper and sectional views of corebox. Fig. 6—Sectional view of completed mold

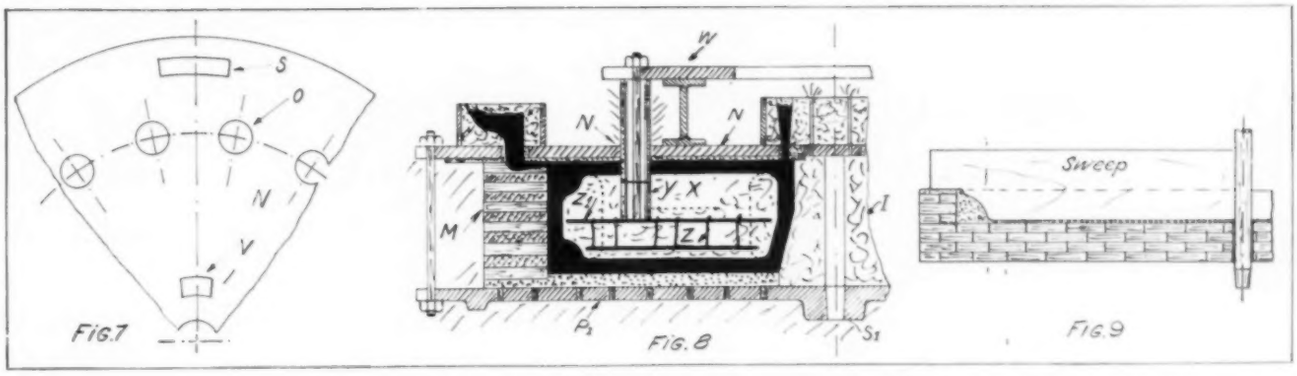


Fig. 7—The cover plate was provided with openings for runner, risers and vents. Fig. 8—In this instance the core was suspended from the cope. Fig. 9—The core was built on a foundation outside the mold

this rib in place at one side of the corebox.

A cross section of the completed mold is shown in Fig. 6. The molder placed a heavy iron plate *K* on a level bed to serve as a foundation. The plate was provided with a hole in the center for the spindle and with numerous vent holes *L*. A heavy layer of loam was spread on the plate and then the bottom of the mold, the center core *I* and the outer wall *M* were built with brick, covered with loam and swept to the desired contour.

After the mold and cores were dried the 16 cores *R*, Fig. 6 were assembled in the mold. The projecting bodies of sand on the sides decided the thickness of the ribs. Gage sticks placed against the vertical face of the mold regulated the thickness of metal in the rim. Each core rested on three spool chaplets on the bottom and the same number were placed on the top. The mold was covered by the loam plate *N* provided with openings at *V* and *S* for runners and risers and further openings *O* for the vent from the cores as shown in Fig. 7.

In making the loam mold for the type of casting shown in Fig. 3 the molder followed a slightly different procedure. The mold was swept in approximately the same manner as in the first instance, with the exception that the center core *I* was handled separately. It was made on the outside and afterward placed in a central point. The principal difference between the two methods was in the construction of the main core and in the elimination of nearly all the chaplets. The main core was formed in loam, swept up as a unit and suspended from the cope plate.

This core might have been swept up according to either of two methods, inside the mold or on the outside. In the first method the mold contour is swept in the usual manner and the loam is allowed to stiffen. Then a thickness of sand is swept on the bottom to correspond to the thickness of metal. On a perfectly flat bottom like that shown in the present instance a number of planks might be laid down. Lagging strips corresponding to the thickness of metal are placed vertically and continuously against the vertical rim of the mold and also the center core. In this manner the mold corresponds to a corebox in which the core may be built and partly dried, then removed and wholly dried.

In a second method, and the one practiced in this instance, the core was built up on a separate plate as shown in Fig. 9. A brick and loam foundation was prepared on the plate and the upper surface was swept to the desired contour. After the face stiffened the rib patterns were set up in their correct positions. These ribs were split along the center lines horizontally to facilitate setting the core arbor as shown at *E* and *F*, Fig. 4.

A coating of loam was spread over the bottom spaces between each pair of half ribs. A core arbor then was set in each space with hooks or loops extending a short distance above the center line. The spaces were filled with brick and loam in the usual manner up to the center line. Then a large arbor was lowered into place with the connecting bars from each division passing through the openings in the ribs. A nut for a ¾-inch bolt was cast in the arbor at eight equidistant points corresponding to the position of eight of the vent openings *a* Figs. 1, 2 and 3. Upper and lower arbors then were clamped firmly together. The upper halves of the ribs *E* Fig. 4 were adjusted in place and the remaining space was filled with bricks, loam and coke. A short piece of 2-inch pipe was erected over each nut in the arbor and was removed after the core had been built to the top and swept to the finished shape.

After the core was dried and lowered into the mold one end of a long ¾-inch bolt was screwed into each nut in the arbor. The cover plate then was lowered into place and a short length of 3-inch pipe was lowered through each of the openings *O* in the cover plate until it came to rest in a print surrounding the bolt on the top side of the core. A supplementary covering ring *W* Fig. 8 then was adjusted in contact with the upper ends of the eight pieces of pipe. Nuts on the upper ends of the bolts then were tightened, thus locking the core securely in position. The cover plate with core suspended was removed temporarily and the space around the pipe in the core and in the cover plate was daubed with loam. *(Please turn to page 54)*

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Slow Melting Permits Bushing Brass To Absorb Gases

We are sending a section of brass bushing which contains many fissures and holes. We are using a forced-draft, coke-fired furnace, and the castings are made on end, gated from the bottom. This trouble happens occasionally and in this particular case, four bushings were poured from the same pot; three of which were good. We run into that trouble with virgin metals as well as with scrap.

Examination of the section of the bushing leads to the opinion that the metal was not melted properly and that it absorbed gases. While you state that the other castings poured from the same pot were good, we believe that careful examination will reveal small pinholes. Evidently, the specimen sent us was from the bushing poured first. Naturally, the temperature of the metal was highest at that time, and the gases had an opportunity to begin migration toward the surface before they were caught by the solidifying metal at the surface. The other castings were poured at a much lower temperature, and most of the gases were not even liberated, but held in suspension.

Extensive investigation of the melting problem has indicated that best results are obtained when the atmosphere is neutral or slightly oxidizing. Reducing atmospheres must be avoided. Since you are using a forced-draft furnace, it is suggested that you eliminate covering the metal with charcoal, and observe the effect. Your metal should melt fast, and it should not be held in the furnace any longer than to obtain the desired excess above pouring temperature for handling, skimming, etc. Do not pour the castings too hot. Experiment, and observe the best pouring temperature. Then stick to it. You will save money in the long run by purchasing a pyrometer for determining your temperatures.

Mathematical Calculation Of Shrink Bobs Proves Complex

We are interested in the mathematical determination of *shrink bobs* for malleable castings that are scientifically correct. Have any researches been published recenty in regard to internal shrink as occurring in actual foundry practice? What is the relation of internal shrink to non-uniformity in castings? From a series of minor tests, it is our belief that a uniform casting with a thin cross sectional area (5/32 to 11/32-inch) can be cast shrink free without the use of a shrink bob. All sections will cool at approximately the same rate of speed.

Quantitative information bearing on the shrinkage of liquid iron, on the density of white iron, and so on, is contained in a paper by H. A. Schwartz entitled "Shrinkage in White Cast Iron" which was presented before the American Foundrymen's association in 1929 and is contained in Volume XXXVII of the *Transactions* on page 205. Information also is carried in the publications of the bureau of standards covering the work of Mr. Ash, research associate, employed by a committee of the American Foundrymen's association to work along that line at the bureau. His work also has been published in the *Transactions* of the A.F.A. in a series of communications.

Some information as to the density of malleable iron as a function of carbon content is contained in a paper entitled "Malleable Iron as a Material of Engineering Construction" by H. A. Schwartz, which was presented before the A.F.A. in 1918 and is contained in Volume XXVII on page 373. The same information appears in the book *American Malleable Cast Iron* also by Mr. Schwartz. These references answer to the best of our knowledge your requirements for information of a quantitative nature.

It must be borne in mind that the solidity of a casting is dependent not only on the density properties of the metal but also on the relative rate of freezing in the casting and feeder. Thus

it is quite likely that the thin casting referred to will freeze about as rapidly as the iron enters it, so that the decrease of volume will be made up during the pouring operation. The explanation is not that of all sections cooling at a uniform rate, but that they all cool in a uniform rate which is faster than the freezing rate of the incoming iron. The rate of heat loss from iron flowing through a gate is so complex a problem involving the diffusivity of liquid and solid irons and of the mold and the form and area of cross section of the channel in which the iron is running that the answer is not known, although the question is entirely intelligent in that it has a definite and specific answer. It is probably true that the reason *shrink bobs* are designed more or less haphazard is that the solution of the problem in physics as to their size, shape, volume and so on is so complex that it has escaped the knowledge of foundrymen. Indeed it may well be that it is so complex that experimentation forms an easier solution than calculation.

Sound, Clean Mold Necessary To Produce Smooth Copper Ingot

Can you give us the name of a good inexpensive wash or dressing for iron molds used for bronze and brass ingots? We have tried many compounds but find fault with them due to the material sticking, staining or discoloring the ingots.

We know nothing that is specially effective for dressing ingot molds that are in themselves not clean and smooth. A really sound ingot mold at the proper temperature should give a good looking ingot, although there are those who claim to have valuable dressings for this purpose.

Painting the mold with a solution of lamp black and a volatile material, like benzine, has been practiced by many and tends to give a fairly clean looking ingot. However, it is a material that must be used with caution, as the volatile benzine must be painted on while the mold is warm and allowed to burn off and leave the lamp black.

Another practice that is common, is to brush the mold with a flame of acetylene which leaves a lamp black coating on the mold. This can be overdone or badly done and consequently becomes a question of how well it is done as to whether it is desirable or not.

Fine Sand Is Needed For Smooth Aluminum Castings

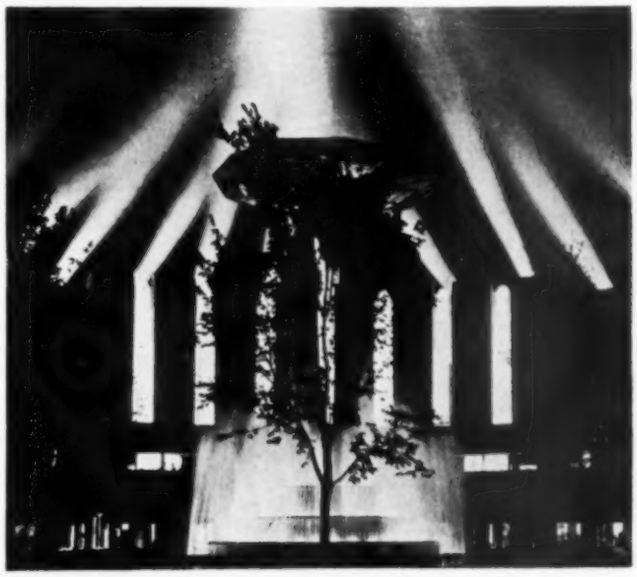
We would like information on making smooth aluminum castings. We are using automobile scrap aluminum and the castings are made thin; $\frac{3}{8}$ to $\frac{1}{2}$-inch thick. Brass sand is used.

Secret of obtaining smooth aluminum castings is to use a fine molding sand. Since the sand is fine, it will have to be rammed lightly—much more so than is the case with brass, otherwise the gases will not be able to escape through the sand, but will strike back into the metal which is approximately one-third the weight of iron or brass.

Pouring temperature is important, and the metal should not be too hot or too cold. If too hot, a poor structure with low strength properties is obtained, and if too cold it will not run properly. The lip of the crucible should be as close to the sprue opening as possible during pouring, and there should be no interruption; keep the sprue filled. Gates should be arranged so that the metal enters the mold quietly without disturbance and turbulence. The metal should be skimmed carefully before pouring to prevent any dross from being carried in with the stream.

The metal should be melted fast, and not permitted to remain in the furnace any longer than absolutely necessary after reaching the desired temperature. When molten aluminum alloys will pick up gases, trouble will result. Use of scrap aluminum may give you plenty of grief due to dross inclusions resulting from the large surface area of the scrap compared to its weight or volume. The surface is covered with oxide of aluminum which is not reduced to metallic form during melting, and tends to be held in the metal unless it is stirred and skimmed well. Many times various fluxes including zinc chloride, cryolite, etc. are added to the metal before skimming with the idea of coalescing the oxide particles into large masses which can be removed easier. The flux of course, should be stirred in well, and then a few moments allowed for its action to bring the particles together before skimming.

Better results will be obtained by using secondary ingot metal if you do not want to go to the expense of new metal. If it is necessary to use scrap, we believe that it is better to melt up the scrap, flux and clean it, and pig it. Then remelt the pigs as desired to make the castings.



Beautifully illuminated fountain in the Electrical Court at the Century of Progress, Chicago—Illustrated courtesy Westinghouse Electric & Mfg. Co.

Use Auto Scrap For Small Cupola Charge

In our 16-inch diameter cupola we propose using automobile cylinder scrap for the charge. We shall add silicon and manganese briquets where necessary to pour castings ranging in thickness from 3/16 to 1 inch. What is the analysis of automobile cylinder iron. What amount of silicon and manganese should be added to the charge. What is the correct spout and pouring temperature? Three 3 x 9-inch tuyeres were cast in sections, top, bottom and sides, afterward machined on the joints and bolted to the shell. Is this a satisfactory form of construction?

A typical analysis of the iron in an automobile cylinder shows: Total carbon 3.30 per cent, silicon 2.20 per cent, sulphur 0.07 per cent, phosphorus 0.20 per cent, manganese 0.65 per cent. In remelting this, or any other iron, the silicon loss is approximately 25 points. Therefore sufficient silicon must be added to the charge to raise the silicon content from 1.95 to 2.75 per cent for castings 3/16-inch in thickness. Correspondingly lesser amounts are added for castings thicker in section up to 1-inch where a minimum silicon content of 2.25 per cent will insure a readily machinable casting.

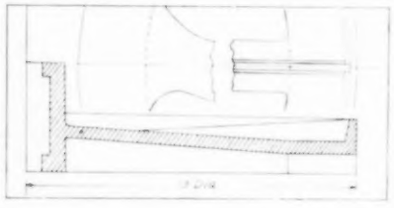
A temperature of 2700 degrees Fahr. is satisfactory at the spout. The pouring temperature ranges from 2400 to 2500 degrees, depending to a considerable extent on the size and type of casting. Tuyeres will buckle with the heat to a certain extent. Therefore we should anticipate better service from a one-piece tuyere than from a tuyere built up from a number of pieces.

Small Gear Wheel Warps on the Flat Rim

We are forwarding a flat ring gear 13 inches in diameter which warps on the rim. The mold is made in a 15 x 15-inch flask with a 3½-inch drag and a 4-inch cope. The deep hub is in the drag and the teeth are cast in the cope. We have taken every precaution in making the mold and have tried every remedial measure with which we are familiar. We shall appreciate your suggestion on how to secure straight castings.

Design of the pattern is responsible for the warped castings. Due to the greater radiation surface provided by the teeth the rim cools much faster than the comparatively heavy arms and hub. Also on account of the resistance offered by these same heavy arms the rim cannot contact normally. Later the arms commence to contract and they pull the rim inward with the result that it springs out of shape. From the abnormally developed fillets where the arms join the rim, we are inclined to the opinion that at one time the arms were inclined to crack and the heavy fillets were introduced to prevent this form of defect. They fulfilled their purpose in this respect, but they introduced the present form of defect, a warped rim.

Change the pattern as shown in the accompanying sketch. The arms may be straight or curved. So far as their



Suggested change in design includes a circular rib on the back of the rim and a radial on the back of each arm

utility is concerned one shape is as good as the other and certainly the straight arm presents less difficulty in pattern construction. However, some designers favor the curved arm, and some foundrymen profess to believe that a curved arm will yield to a greater extent than a straight arm. Personally we do not hold with that theory, first because cast iron is not a ductile metal and, second, if an arm is strained almost to the breaking point, it is not a safe member of a casting. The aim of the foundryman should be to produce a casting in which no strains are present.

Redesign the pattern with the arms sloping toward the rim. Place a circular rib ¼-inch thick and ⅜-inch high on the back perimiter of the rim and place a small rib on the back of each arm to connect with the rib around the rim. In addition you may find it advisable to butt the sand hard over the rim after the casting has set. This will prevent the heat from radiating too rapidly.

Makes Ornaments Of Zinc Base Alloys

We would like to obtain information on a suitable alloy for making of automobile radiator ornaments which are to be chill-cast and then plated.

In general the major portion of automobile radiator ornaments, door handles and many other parts in this country, are pressure die cast in zinc-base alloys. Your reference to chill-cast indicates that you contemplate use of metal molds without application of pressure to force the metal into the molds, but that does not prevent the employment of alloys similar to those used for die casting.

One alloy that is giving good results is one containing 2.5 to 3.5 per cent of copper; 3.5 to 4.5 per cent aluminum; 0.02 to 0.10 per cent magnesium, and the remainder zinc of the highest grade. This is a proprietary alloy. Another alloy which has been used successfully contains 91.5 per cent zinc; 4.5 per cent tin; 3.75 per cent copper, and 0.25 per cent aluminum.

If you desire to use an aluminum alloy, the regular No. 12 alloy containing 8 per cent copper and 92 per cent aluminum, or a variation containing up to 2.5 per cent zinc will serve. Also it may be possible, if the castings you have in mind are not too intricate, to use an alloy containing 13 per cent zinc, 3 per cent copper and remainder aluminum. Due to its high zinc content, that alloy is hot-short, and you may have trouble with iron molds which do not give like sand molds.

Gives Mixture For Trolley Car Wheels

Can you give us a suitable mixture for trolley car wheels?

A suitable mixture for trolley car wheels that is used widely contains 92 per cent copper, 6 per cent tin, and 2 per cent zinc. However, if there is any objection to the use of zinc by the purchaser, the following alloy may be substituted. It contains 92.5 per cent copper; 7 per cent tin, and 0.5 per cent phosphor-copper (15 per cent phosphorus). An extremely hard alloy suggested for use against a steel wire instead of the usual copper wire is made up of 80 per cent copper; 10 per cent tin, and 1 per cent phosphor-copper (15 per cent phosphorus).

Core Is Not Dry In Long Steam Cylinder

We are having trouble with a steam cylinder 39 inches diameter, 9 feet in length and 2½ inches thickness of metal. The casting is molded in an iron flask and poured on end. The core is an oil sand mixture about 3 inches thick on a cast iron arbor. Gas or steam from this core formed holes in the casting.

Basing an opinion merely on the data submitted, the logical inference is that: (a) The core was not sufficiently dried, (b) The arbor was not provided with a sufficient number of vent holes, (c) An excessive amount of binder was used in the sand. Any one or a combination of any of these factors would cause blowholes in the casting. The obvious remedy is to provide a liberally vented arbor, dry the core slowly and thoroughly and cut down on the amount of binder. Under these conditions the iron will lie quietly against the face of the core.

Viewing Foundry Developments

At Short Range

A LARGE foundry uses a bosched cupola because it believes that type of unit gives more uniform iron. This is due chiefly to the fact there is less tendency for bridging, and better combustion of the coke is permitted. When the charge descends and reaches the bosch melting zone, there is a tendency to compress the charge, thus giving better melting conditions.

• • •

Only a few alloyed steels can be nitrided satisfactorily, but one of the best is a chromium-vanadium steel with 1.50 per cent chromium, 0.30 per cent carbon, and 0.50 per cent vanadium. That steel can be nitrided at low temperatures and has good physical properties.

• • •

FOR medium heavy work and relatively deep drawing, such as forming sheet steel into sinks, kitchen utensils, radiator shells, etc., cast iron dies of the following composition have been recommended: Total carbon, 3.00 to 3.40 per cent; manganese 0.60 to 0.90 per cent; phosphorus under 0.30 per cent; sulphur under 0.12 per cent; silicon 1.00 to 1.50 per cent; nickel 2.50 to 3.00 per cent and chromium 0.60 to 1.00 per cent.

• • •

Use of aluminum in amounts not to exceed 0.05 per cent is said to increase strength of malleable iron about 4 per cent and to increase elongation 30 per cent.

• • •

When used for light duty, such as drawing thin sheet with light draft and full curves, as for example bodies and fenders for light cars, cast iron dies of the following composition have been recommended: Total carbon, 3.00 to 3.40 per cent; manganese, 0.60 to 0.90 per cent; phosphorus under 0.30 per cent; sulphur, under 0.12 per cent; silicon, 1.25 to 1.75 per cent; nickel, 1.25 to 1.75 per cent; and chromium, 0.50 to 0.75 per cent. The silicon and chromium should be varied according to the thickness of the dies.

• • •

IN ADDING chromium to iron to obtain a particular result, it is necessary that the amount of chromium must be strictly proportional to the characteristics of the base metal. For example, to obtain a machinable iron, 1 per cent chromium might be satisfactory if the base metal is high in carbon and silicon. However, if 1 per cent chromium should be added to a low carbon, low silicon iron, the resulting casting probably would be white and hard.

• • •

Use of sand of high permeability and special attention to gates and risers are necessary in casting magnesium alloys, due to the lightness of the metal and the resultant difficulty in forcing air and gas from the mold. Generally castings should be gated as near the bottom as possible, and poured at the lowest practicable temperature.

• • •

As a result of establishing standardized practice in methods and materials for steel ladles, including the setting of nozzle bricks and stopper rods, a prominent mid-west steel foundry reports there has not been an accident of any kind in pouring heats over a period of 15 years.

• • •

Under stress of circumstances in many instances foundry cranes are forced to lift loads greatly in excess of their rated capacities. Apparently crane manufacturers provide for these occasional contingencies. In a recent instance a 30-ton crane was employed to carry a steel casting from the casting pit to the cleaning floor. Combined weight of casting and enclosed cores was approximately 60 tons.

• • •

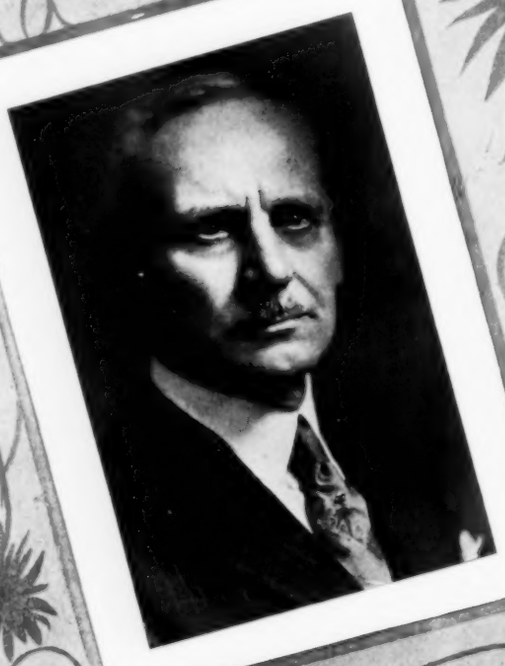
A NEW silvery alloy pig iron has been developed by an eastern blast furnace interest. This pig iron, intended for cupola production of high quality iron, has the following analysis: Carbon, 1.80 to 2.00; silicon, 8 to 12; manganese, 3 to 3.5; nickel, 0.50 to 0.75; phosphorus, below 0.10; and sulphur, below 0.05.

• • •

A series of fluxes suitable for aluminum alloys is described in a recent patent as containing from 10 to 65 per cent potassium chloride, 15 to 75 per cent sodium chloride and 5 to 65 per cent cryolite. For alloying aluminum with various agents the flux is given as containing 62.5 per cent potassium chloride, 32.5 per cent sodium chloride and 5 per cent cryolite. When

melting scrap such as borings, etc., the composition recommended is 25 to 65 per cent potassium chloride, 25 to 75 per cent sodium chloride and 5 to 40 per cent cryolite. For skimming and cleaning preparatory to pouring the flux is composed of 10 to 50 per cent potassium chloride, 15 to 25 per cent sodium chloride and 25 to 65 per cent cryolite.

The FOUNDRY Family Photograph Album



Upper Left
A. E. HARRISON
Allis-Chalmers Mfg. Co., Milwaukee

Upper Right
W. J. MATON
Waterbury Farrel Foundry & Machine Co.
Waterbury, Conn.

Lower Left
V. S. VEENMAN
Nolte Brass Foundry Co., Springfield, O.

Lower Right
JOHN B. STRAUCH
National Bearing Metals Corp., St. Louis

Men of Industry

Whose Activities Are Making Foundry History

WILLIAM J. MATON, (see foundry album on opposite page) superintendent of the foundry department of the Waterbury Farrel Foundry & Machine Co., at Waterbury, Conn., recently was elected president of the Connecticut Foundrymen's association for the third consecutive year. Mr. Maton was born at

Richard L. Templin

Mystic, Quebec, Canada. His parents moved to Waterbury when he was 6 years old and he was educated in the public schools of that city. He entered the employ of Waterbury Farrel Foundry & Machine Co., Feb. 1, 1890 at the age of 14 and has been employed continuously by that firm since that time. In July, 1904, he was transferred to the foundry department and later became foundry superintendent.

E. S. McCLELLAND recently retired as director of personnel of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. McClelland started with that company in 1881, and at the age of 17, he became a helper in foundry of the Westinghouse Machine Co. From foundry helper, Mr. McClelland advanced to the pattern shop, the production department, the drafting department, and the engineering department. He became assistant chief engineer, then assistant general superintendent, and later works manager. In 1920 he was appointed director of personnel.

Richard L. Templin, chief engineer of tests, Aluminum Research Laboratories, New Kensington, Pa., recently was awarded the Charles B. Dudley medal by the American Society for Testing Materials for his paper "The Fatigue Properties of Light Metals and Alloys." The paper includes a discussion of various types of fatigue tests made on light metals and alloys and a description of the types of machines and apparatus used in tests made by Aluminum Co. of America.

Mr. Templin has held his present position as chief engineer of tests since 1919, when he joined the research staff of Aluminum Co. of America after 2 years of work as an engineer physicist in the bureau of standards, Washington. Graduated from the University of Kansas in 1915, where he received the degree of bachelor of science in civil engineering, Mr. Templin took up post graduate work at the University of Illinois, as a research fellow in the Engineering Experiment station. At Illinois he received a master's degree in theoretical and applied mechanics.

V. A. OLSEN, formerly assistant works manager has been appointed works manager of the Cadillac Motor Car Co., Detroit. Mr. Olsen has been connected with the Cadillac company for 16 years, beginning in the tool designing department and later becoming assistant superintendent of tools and equipment. Three years later he was made superintendent, and on May, 1932, assistant works manager.

C. A. RAFTREY has been appointed assistant to Mr. Olsen.

ROBERT S. ACHER, formerly director of metallurgy, A. O. Smith Corp., Milwaukee, and previously connected with the Cleveland section of the Aluminum Research Laboratories, Aluminum Co. of America, Cleveland, recently was appointed chief metallurgist of the Chicago district of the Republic Steel Corp., Youngstown, O.

JOHN E. McCAULEY has been appointed president of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., following a reorganization of officers of the company. He formerly was vice president and general manager.

John E. McCauley

ROBERT E. BROOKE, formerly president, has been elected chairman of the board. GEORGE BROOKE has been named a vice president.

ROBERRT F. WHITCOMB, formerly associated with the Ohio Cultivator Co., Bellevue, O., and the Brown Clutch Co., Sandusky, O., has accepted a position as general foreman for the Enterprise Foundry Co., Detroit.

W. H. BASSETT, (see page 16) metallurgical manager, American Brass Co., Waterbury, Conn., recently was elected as president of the American Society for Testing Materials. Mr. Bassett was graduated from the Massachusetts Institute of

Technology in 1891 and then became chemist with the Popes Island Mfg. Co., New Bedford, Mass. Later he became superintendent and remained with that company for 5 years. He then accepted a position as teacher of chemistry at Swain Free school, New Bedford, and remained there until 1900 when he became associated with the New Jersey Zinc Co. as chief chemist at their Newark works. In March, 1902, he became chemist for the Coe Brass Mfg. Co. and in 1903 was made chief chemist and metallurgist of the American Brass Co. In 1912 he was made technical superintendent and metallurgist and in 1930 he became metallurgical manager.

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K. D. Crawford has been appointed Pittsburgh manager of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., succeeding the late J. R. Smith. Mr. Crawford formerly was associated with the American Frog & Switch Co.

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L. S. Peregoy, Sivyer Steel Casting Co., Milwaukee, recently was appointed a member of the code authority of the steel casting industry, to fill a vacancy created by a recent change in the by-laws of the society which provides for a separate director to represent the geographical division from which the president of the code authority is elected.

Paul S. Leussler, Omaha Steel Works, Omaha, Nebr., has been made a member of the code authority of that industry to fill the vacancy created by the death of Ernest H. Cornelius, Oklahoma Steel Castings Co., Tulsa, Okla.

❖ ❖ ❖

Edward A. Johnston, director of engineering, International Harvester Co., Chicago, has been elected vice president in charge of engineering. He joined the company in 1894 as a machinist and patternmaker in the experimental department of the McCormick Harvester Machine Co.

Albert A. Jones, for the past five years assistant to the vice president in charge of manufacturing, has been elected vice president in charge of manufacturing. He has been identified with the company since 1904 when he started as auditor of the McCormick works.

To Handle Complaints

The acting division administrator Barton W. Murray signed an order on June 12 permitting the code authority of the nonferrous foundry industry to handle trade practice complaints and complaints against a competitor for non-compliance with the code's labor provisions.

A. F. A. Committee Nominates Officers

The committee to nominate officers and directors of the American Foundrymen's association met in Atlantic City, N. J., June 28, and designated the following:

For president to serve one year, Dan M. Avey, Penton Publishing Co., Cleveland; for vice president to serve one year, B. H. Johnson, R. D. Wood & Co., Philadelphia; for directors to serve three years, E. W. Campion, Buckeye Steel Castings Co., Columbus, O.; E. O. Beardsley, Beardsley & Piper, Chicago; A. E. Harrison, Allis-Chalmers Mfg. Co., Milwaukee; Frank J. Lanahan, Fort Pitt Malleable Iron Co., Pittsburgh; and Sam Tour, Lucius Pitkin, Inc., New York.

The nominating committee consisted of N. K. B. Patch, Lumen Bearing Co., Buffalo; E. H. Ballard, General Electric Co., West Lynn, Mass.; T. S. Hammond, Whiting Corp., Harvey, Ill.; A. L. Boegehold, General Motors Research Laboratory, Detroit; W. C. Hamilton, American Steel Foundries, East Chicago, Ind.; E. F. Hess, Ohio Injector Co., Wadsworth, O.; and E. E. Griest, Chicago Railway Equipment Co., Chicago. Messrs. Patch, Ballard and Hammond served on the committee as past presidents and the others mentioned were elected at the annual business meeting of the association in June, 1933.

Equipment Firm Celebrates Anniversary

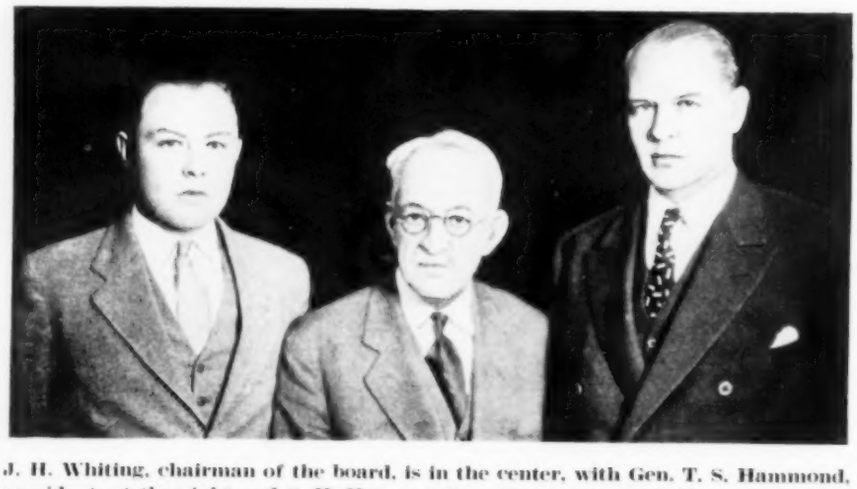
This year the Whiting Corp., Harvey, Ill., is celebrating the 50th anniversary with John Hill Whiting, the founder, still active as chairman of the board. Mr. Whiting began his business career in Detroit in the seventies as a clerk in a car wheel foundry and before many years rose to the position of superintendent. During that time he had developed a number of improvements in cupola construction and in 1884 he organized the Detroit Foundry Equipment Co. to produce a cupola and a car wheel cleaning machine. The business grew and additional items of equipment were developed such as a car wheel system, ladles, core ovens, tumbling mills, cars, trucks, turntables, air hoists, cranes, etc.

In 1894 the company was moved to Harvey, Ill., and the name changed to the Whiting Foundry Equipment Co. Later the name again was changed to the Whiting Corp. Several subsidiary companies have been taken over including the Swenson Evaporator Co., manufacturer of evaporators, crystallizers and filter equipment for the process industries; the Grindle Fuel Equipment Co., producer of pulverized coal machinery; and the Joseph Harrington Co., manufacturer of automatic stokers for industrial and commercial use.

Gen. T. S. Hammond, president of the corporation, has been associated with Mr. Whiting for the past 30 years. The third generation is represented by Mr. Whiting's grandson, Stevens H. Hammond, assistant to the president.

Induction Furnace Code Authority Approved

Personnel of the code authority for the industrial furnace manufacturing industry, as recently approved by the NRA, is as follows: Chairman, A. D. Dauch, manager of sales, George J. Hagan Co., Pittsburgh; W. B. Wallis, president, Pittsburgh Lectromelt Furnace Co., Pittsburgh; H. G. Dixon, president, H. L. Dixon Co., Carnegie, Pa.; W. H. Cosgrove, vice president, Swindell-Dressler Corp., Pittsburgh; and F. M. Hartford, Allied Engineering Co., Cleveland.



J. H. Whiting, chairman of the board, is in the center, with Gen. T. S. Hammond, president, at the right and S. H. Hammond, assistant to the president, at the left

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

FOUNDRYMEN engaged in the production of gray iron castings, at times are moved to question the necessity of the large risers usually placed on nearly all steel castings. A little actual experience in the field rapidly would convince these doubters that the peculiar structure of the metal and high shrinkage qualities of cast steel necessitate the use of large risers, in many instances as heavy or even heavier than the casting itself. Owing to the large amount of metal involved and the high percentage of remelt resulting from every heat, the advisability, desirability and feasibility of reducing the size of the riser heads on any given steel casting, have supplied an endless topic of discussion wherever two or more steel foundrymen foregather.

Every man favors a reduction and consequent saving of metal—but—this saving must accrue without jeopardizing the value of the casting. Which is another way of saying that in all instances a solid casting is the first consideration, free from any form of shrinkage defect, a casting on which the services of the welding and reclaiming department are not required.

Cost of repairing shrinkage defects by welding probably has prevented many foundrymen from experimenting extensively with various sizes of risers. The general practice has been to stay on the safe side at all times, and in keeping on the socalled safe side, risers beyond the size actually needed have been used. Every pound of metal included in the risers beyond the amount actually needed to insure a solid casting represents a loss to the foundry. This loss is distributed through shrinkage in melting, rehandling and remelting. Even 5 per cent in the riser loss will amount to a considerable amount in a short time.

In electric steel foundries operating on light and medium weight castings where the return in the form of risers rarely is less than 25 per cent the large amount of steel thus returned to the furnace presents a serious problem. The method practiced in one steel foundry where metal is melted both by the converter and electric furnace has been found satisfactory over a period of several years in the saving effected in the quality of the castings.

In this foundry the size of each riser has been reduced by substituting a cone shape riser for the usual riser with straight sides. The riser is made in a core sand ring and the large end of the cone is placed over the neck of the riser. In many instances the neck of the riser is incorporated in the riser core and is rammed in the cope. Sand mixture used in these core rings is the same as that employed regularly in runner boxes, or pouring cups. The cores are produced easily and rapidly with little expense incurred in the manufacture of corebox es. Different size riser openings are secured with the same outside corebox ring by using different size blocks to form the openings. Amount of core sand lost in this manner constitutes only a small item compared with the actual saving in molten metal. The accompanying sketch shows a cross section of one of these riser cores.

Advantage of this type of riser readily is apparent, giving as it does a greater body of molten metal at the point where it is most needed. A reduced metal surface is exposed to the cooling influence of the air at the top of the riser. This arrangement allows the metal to remain in the molten state for a longer time than usual and permits the feeding action to continue for a comparatively longer period.

In a riser of this type the shrinkage takes place in the center and thus the feeding of the casting is accomplished more satisfactorily. The cone shape saves the amount of metal that would be required to carry the riser straight up. In many instances this saving amounts to 25 per cent or more of the metal in the straight side riser formerly used.

Although a greater volume of metal may be present in the straight side riser, the design prevents this volume from being used to advantage. The large metal surface at the top of the riser cools rapidly and therefore is of no value in furthering proper feeding. Herein lies the reason why the cone shape riser feeds the casting to better advantage without the waste of metal inherent to the riser with straight sides.

Height of the riser cores varies from 6 to 12 inches and the standard diameters are as follows: Bottom 4 inches, top 2 inches; bottom 6 inches, top 3 inches; bottom 8 inches, top 5 inches; bottom 10 inches, top 7 inches.

Porosity as distinguished from shrinkage in steel castings may be due to one or a combination of many causes. In some instances the cause readily is apparent, while in others the cause is so obscure and hidden that considerable painstaking inves-

Use Cone Risers

A CONSIDERABLE saving in the total amount of metal melted for any given tonnage of castings is claimed where a cone shaped or tapered riser is substituted for the straight side riser usually employed. The base or largest area of the riser keeps the metal liquid close to the casting where it is most needed. Pressure on the metal in the casting is determined by the height of the riser irrespective of the diameter at the top or bottom. Production in standardized sizes of the core shells which enclose these risers also to a great extent eliminates the human element hazard where the size, shape and position of the riser are left to the individual opinion or whim of an unskilled or semiskilled operator. The shells may be rammed in small quantities by hand or rapidly in large numbers on a plain jolt machine.

tigation is required for correct diagnosis.

Among the many causes of porosity may be listed incompletely deoxidized metal, excessive moisture in the sand, too much farinaceous binder in the facing sand, carbonaceous material in the facing sand introduced as particles of coal in the fire clay or splinters of wood, facing or backing sand low in permeability, lack of artificial venting with a wire or other means.

Unfortunately in many instances a casual or even a rigid surface inspection in the foundry will not reveal porosity. Usually the defect is not disclosed until after the casting has been delivered and the customer has machined it. Confronted with the rejected casting the foundryman for the moment may be at a loss to account for the porosity. Unless one is familiar with the entire case history of the specimen, one guess is as good as another. This is particularly true where a considerable period of time has elapsed between the casting time and the date of complaint.

An extreme instance of this kind is mentioned by a midwest steel foundryman. A casting 4 feet in diameter was made in a dry sand mold and fed from five adequate risers spaced equidistantly. In the subsequent machining operation, porous areas were disclosed on the upper face of the casting in five positions corresponding to the positions of the risers. Persistent investigation, elimination in turn of all possible contributory factors finally disclosed the important fact that on the night the casting was poured, rain had fallen upon the mold for some time through an open skylight. The night foreman decided that the amount of rain blown into the risers would do no harm and the casting was poured in the regular routine. His error of judgment resulted in a scrap casting even though gates, risers, mold and metal conformed to proper standards.

Shrinkage Cavities Escape

Shrinkage cavities in apparently sound castings cause a great deal of trouble through the ease with which they escape detection in ordinary inspection. Surface oxidation, the result of normal heat treatment seldom reveals the presence of shrinkage defects. Usually they are surrounded with a relatively thick unbroken covering of solid metal.

Shrinkage cavities are due to an insufficient supply of liquid metal with which to compensate for the normal contraction in volume. A variety of circumstances determine their position and extent, design of the casting, location and shape of the feeding heads, position of the mold, size of the fillets, interposition of small bodies of sand incapable of radiating the heat produced in them and other conditions that interrupt the normal solidification and feeding of sections.

For example, the initial casting on a certain order was sawed in two to discover if any hidden flaws were present. The casting was perfectly solid and the greatest care was taken

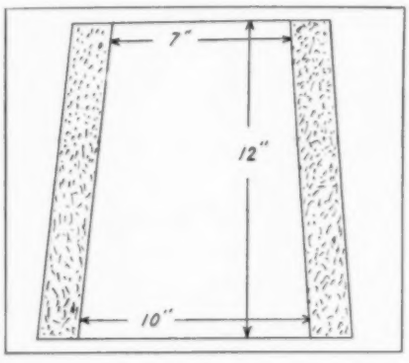


Fig. 240—The cone riser is enclosed in a thin ring of dried sand

to see that all castings on that order were produced in a manner similar to the first. A second order apparently made in the same manner passed through the production routine to the final rigid inspection. A slight cavity in one of the bosses was explored by the welder who found that it was of unexpected size. All the castings on the order then were examined minutely and revealed somewhat similar cavities. In following up this clue it was found that the molder had substituted a cope 2 inches shallower than the cope used in the first instance. He had saved himself a considerable amount of work, but the castings had to be scrapped. The reduction in the height of the riser had hastened the cooling to the extent that the neck and a portion of the boss had solidified before the feeding function was concluded. The heavy section was unable to secure the proper amount of feeding metal.

Importance of proper pattern design was shown in a combined sleeve, flange and clutch jaws. Extensive machining operations were almost concluded before a shrinkage line was discovered at the junction of the sleeve and the flange. The pattern was made to be molded with the sleeve in the cope. Reversing the method was not feasible on account of the difficulty of placing risers on the flange supporting three lugs. The difficulty was overcome by the construction of a new pattern designed to be molded horizontally with ample room for proper risers.

A small clutch ring is a familiar example of the manner in which a heat retaining core interferes with uniform cooling and the proper function of a feeding head. The pattern is constructed to simplify the molding by placing the jaws in the bottom and by forming the neck with a comparatively thin ring core. The riser is placed on the comparatively thin flange above the ring.

Shows Lack of Thought

If proper consideration be given this problem it will be seen that the ring core will interfere with the passage of the feeding metal from the riser to the heavy jaws in the bottom. In the progress of cooling, the radiation of temperature in the outer face of the neck cannot approximate that in the upper and lower parts of the casting. The jaws below and the flange and riser above have ample surface for heat transmission, while the cooling of the neck is dependent wholly on radiation through the core. The clutch jaws satisfy their contraction requirements by drawing liquid metal from the neck, but this will leave a cavity in the neck since the metal in the thin flange between core and riser will freeze while the metal above and below are still liquid. Obviously the remedy for this condition is to reduce the size of the ring core, or remove it altogether.

Hair line cracks, usually found in recesses not susceptible to careful examination occasionally are found in rejected castings. They may be caused by strains set up in cooling or by inclusions in the metal. Fine cracks—if present—usually are discernible where the heat treatment scale is removed by pressure blasting, but in nearly every instance their discovery depends on very close inspection while the casting is in the rough state. In the majority of instances their presence is not discovered until after the casting has been partially or completely machined.

Unless the casting is designed in a manner that places control of this form of defect outside the range of practical foundry accomplishment, the foundryman can prevent the development of fine cracks by manipulation of the mold or the metal. Introduction of chills will increase the speed of cooling at the point of application and cause the strain to be transferred to a more favorable position where the force is absorbed and later removed or diffused in the heat treatment.

Thin brackets or fins are employed extensively to hold metal together under the cooling strain in sections addicted to cracking. In many instances a change in the gating or heading arrangement, a change that affects the temperature of the susceptible section, is all that is necessary to prevent the formation of cracks. In other instances unrestricted contraction is facilitated by shaking out the casting as soon as it has solidified sufficiently. In still other instances the mold is *eased* to

(*Concluded on page* 36)

E. M. BRIQUETS

FOR CUPOLA ADDITION

GIVE YOUR IRON PROTECTED ALLOYS

WHEN you add ferro-chromium, ferro-manganese, or ferro-silicon in the cupola in its ordinary form, you weigh the alloy carefully and shovel it in. After that, factors beyond your control determine the amount that will be wasted by premature oxidation before it reaches the hottest zone. Cost-inflating off-iron often is the result.

What can you do about it?

The answer is to add a specified number of E. M. BRIQUETS with the cupola charge. Each E. M. BRIQUET contains an unvarying amount of metallic chromium, manganese, or silicon in a refractory binder which protects it from premature oxidation. At the hottest zone of the cupola, the binder disintegrates and releases the full charge of the uncontaminated element to the iron. Recovery is higher. Thorough solution is assured. Guesswork and waste are eliminated.

Electromet Metallurgical Engineers will be glad to explain how E. M. BRIQUETS can be used to advantage in your foundry. Write today for further information.

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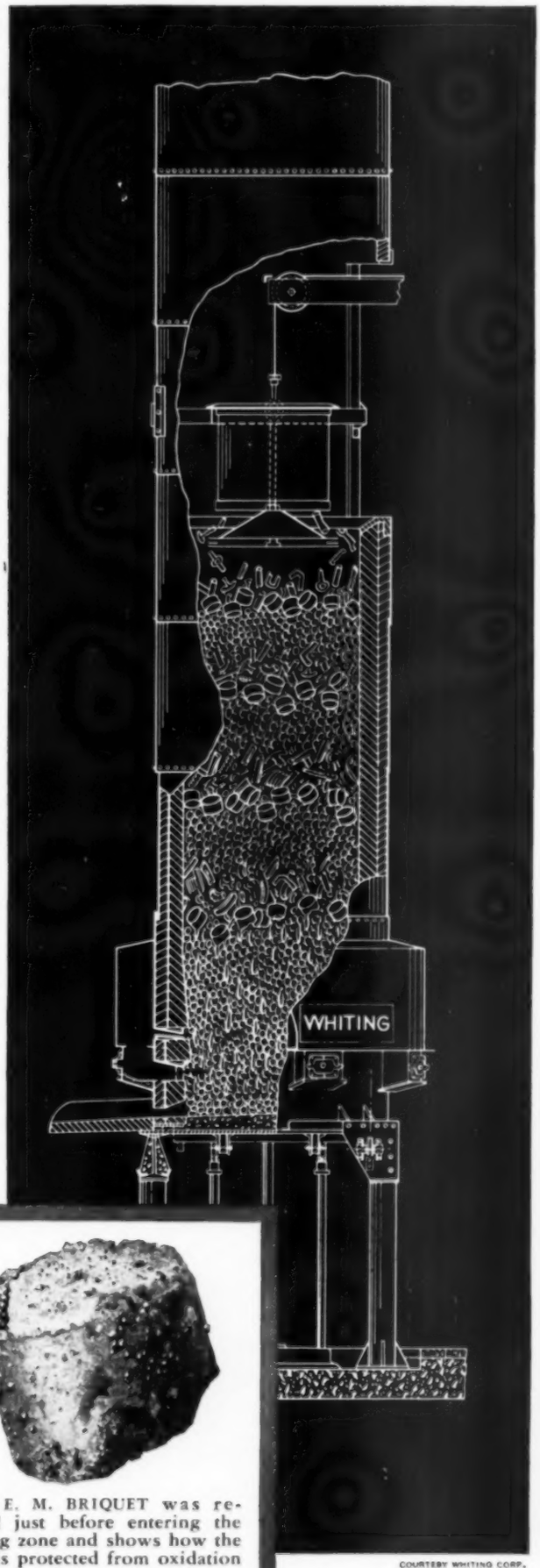
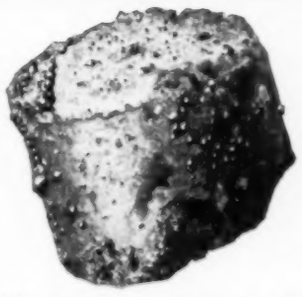


COURTESY WHITING CORP.



This E. M. BRIQUET was removed just before entering the melting zone and shows how the alloy is protected from oxidation during its descent through the upper oxidizing zone of the cupola.

(*Concluded from page* 34)

a certain extent by breaking cores, removing bars, releasing bolts or other devices which interfere with normal contraction of the casting.

Since each step in the production of a steel casting is beset with many possibilities of error, a slight digression quite properly may be introduced at this point in the form of a brief comment on some of the more usual causes of grief in a steel foundry. Many defective castings may be traced to slight variations in the qualities of the raw materials, but even with ample equipment, best materials procurable, exacting and highly competent supervision, the menace of that uncertain but highly important factor, the human element constantly lurks in the shadow of each operation in the steel foundry.

Offhand any experienced steel foundrymen can list instances of costly errors committed by various employes, the melter rushes the last heat, the sand mixer guesses at the amounts of the various ingredients and at the mixing time, the molder forgets or neglects to vent a certain part, he substitutes heap sand for facing sand, he uses poor judgment either in the number of location of chills, he employs risers inadequate in size or in unsuitable position, he sets broken cores, cores in improper position or neglects to anchor cores properly.

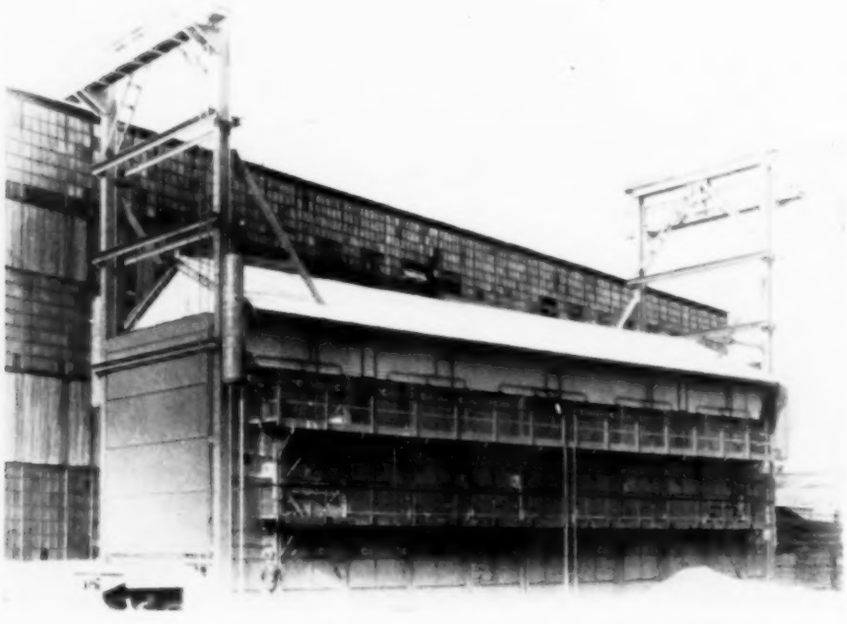
In the cleaning department the blast man skimps the corners, the grinder removes too little or too much, the welder smears his welds, the chipper does not clean the castings clean, the oven tender allows the burners to run themselves, the mill man allows the tumbling barrels to run too long and mutilates some of the castings, the inspector misses what he should catch and finally the shipper attaches the wrong tags to the shipments, or transposes his weights.

The pessimistic note in the foregoing presentation probably will be regarded by some foundrymen as an exaggeration. Every one of these afflictions probably will not fall on the same day, yet at one time or another every one has fallen within the experience of every foundryman.

Present day foundry conditions, particularly in the large group known as jobbing foundries producing a miscellaneous line of castings, provide an infinite number of opportunities for the creation of defective castings. A radical change has taken place in the working personnel of the foundry in the past decade. Formerly the foundries were manned by skilled molders requiring a minimum amount of supervision. With the advent of the machine the degree of personal skill and pride of craft has declined, thus throwing an additional burden in the form of constant, intimate and critical inspection, on the shoulders of the supervisory force.

In this connection it is interesting to note that in many steel foundries the production of pouring cups has been standardized to the extent that one man attends to this job exclusively and in that manner becomes highly proficient with a consequent reduction in the cost of this item. In limited amounts the cups are rammed by hand, but in larger numbers it has been found that a small plain jolt machine is a paying investment. Large cups, also the sink heads referred to earlier in the present article are rammed singly, but the smaller sizes are made, two, four and in some instances six at a time.

This is the fifty-fourth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The fifty-fifth installment will appear in an early issue.—THE EDITORS.



Large car bottom type furnace used to anneal steel castings

Annealing Furnace Equipped with 62 Burners

Sun Shipbuilding & Dry Dock Co., Chester, Pa., recently installed an exceptionally large car bottom furnace which will be used for annealing large steel castings and for relieving stresses in welded steel work such as pressure vessels. The inside dimensions are 80 feet long and 18 feet wide and the furnace is equipped with 62 two stage, high pressure burners supplied by the Surface Combustion Corp., Toledo, O. The latter are so distributed that over and under firing is obtained, and they are staggered so as to eliminate hot spots and to give uniform temperatures throughout the chamber.

The burners are of the automatic proportioning type to give a constant atmosphere in the furnace at all times, whether the burners are operating at maximum or minimum pressures. Gas at 10 pounds pressure with a heat content of approximately 530 B.t.u. is used. Each burner has a capacity of approximately 600 cubic feet per hour, with a total of about 38,000 cubic feet for all burners. The large turn down range of the particular burners allows the use of all burners for the lower temperatures of 1100 to 1600 degrees Fahr. as well as the higher range of 2000 to 2400 degrees Fahr.

The furnace is divided into five heat zones, comparable to a loaf of bread cut into five equal parts. Each zone consists of 12 burners, six on each side, all controlled by a couple and automatically operated fuel supply valve. The importance of temperature control in this furnace is indicated by the fact that 16 temperatures are recorded while 12 points are connected to indicating instruments.

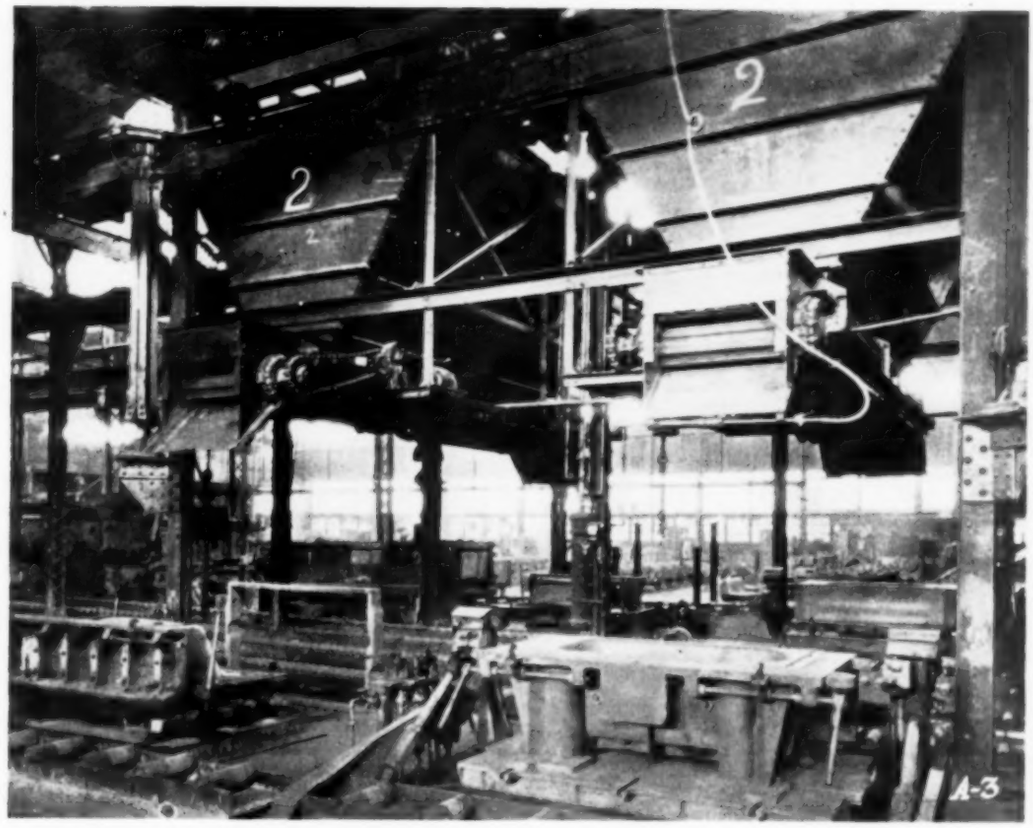
Opens Warehouse

Link-Belt Co., 910 South Michigan avenue, Chicago, recently opened a warehouse at 413-15 Second avenue, Dallas, Tex. E. G. Wendell is resident manager.

Quad-City Foundrymen's association held its twelfth annual picnic on Saturday, June 16, near Moline.

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES



Sanitary Ware

Bath tubs, sinks, lavatories and tanks are not easy castings to make, yet there are many Herman installations on this work in this and in other countries.

When the above photograph was taken, apron front tubs were being run on both units in this plant. Drags are made on a Herman Jarr-Rollover, copes on a Herman Jarr-Stripper.

The finished drag mold is deposited directly on the roller conveyor, no lifts being necessary. The cope is stripped, then closed on the drag and the completed mold rolled to the pouring station.

Rolling over, drawing the pattern, and stripping are all hydraulically controlled. The smooth steady action assures good draws without sacrificing that requisite of production, speed.

HERMAN PNEUMATIC MACHINE COMPANY

GENERAL OFFICES: Union Bank Building PITTSBURGH, PA.
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.
Foreign Works: Pneulec Limited, Mafeking Rd., Smethwick, near Birmingham, England
Hartung Aktiengesellschaft, Berlin, Lichtenberg, Germany
Gibson Battle & Co., Limited, Sydney, N. S. W

Electric Metal Makers Guild Meets

First technical meeting of the Electric Metal Makers guild was held at the Pittsburgh Athletic association, Pittsburgh, June 29 and 30.

The meeting was attended by: Herman Schulz, Illinois Steel Co., Chicago; A. E. Kayes, International Nickel Co., Huntington, W. Va.; J. A. Scott, Driver-Harris Co., Harrison, N. J.; Leroy Bash, Timken Steel & Tube Co., Canton, O.; David J. Giles, Latrobe Electric Steel Co., Latrobe, Pa.; John S. Williams, Reading Steel Casting Co., Reading, Pa.; J. H. Chivers, Crucible Steel Co. of America, Park works, Pittsburgh; Harry F. Walther, Timken Steel & Tube Co., Canton, O.; J. A. deBondy, Manitoba Steel Foundries, Selkirk, Manitoba, Canada; Fred B. Anderson, United States Navy Yard, Portsmouth, Va., F. J. Blaney, Ohio Steel Foundry Co., Springfield, O.; M. M. Townsend, Atha works, Crucible Steel Co. of America, Harrison, N. J.; A. D. Potts, Simonds Saw & Steel Co., Lockport, N. Y.; Alex C. Texter, Canadian Atlas Steel Co., Welland, Ont., Canada; F. M. Hicks, Henry Disston & Sons, Philadelphia; R. S. Read, Halcomb Steel Co., Syracuse, N. Y.; Bert J. Aamodt, National Malleable & Steel Casting Co., Chicago; L. B. Knox, Firth-Sterling Steel Co., McKeesport, Pa.; J. N. Brookfield, Ludlum Steel Co., Dunkirk, N. Y.; and W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh.

At the business meeting of the guild, A. E. Kayes of the International Nickel Co., was elected president, R. S. Read of the Halcomb Steel Co. was elected vice president, and Joseph A. Scott of the Driver-Harris Co. was elected secretary-treasurer.

The meeting on June 29 was devoted to a technical session on slags, a paper being read by Mr. Kayes of the International Nickel Co. A paper was also read by Mr. Giles of the Latrobe Electric Steel Co. on "Ingot Mold Design." On June 30 a paper was presented by J. H. Chivers of the Crucible Steel Co. of America on the subject of "Basic Practice." There was considerable discussion on all of these papers and a large part of the time for discussion was devoted to the use of alloys in steel under the subject of "Furnace Practice."

The first technical meeting, following the organization meeting at Chicago, showed an increase in growth from 13 charter members at the organization meeting last year to 27 members of the guild with a number of applications for membership pending.

It is proposed to have the next annual meeting at the same place and approximately the same time as the meeting of the open-hearth committee.

General offices of the guild are: Electric Metal Makers Guild, c/o J. A. Scott, secretary-treasurer, 166 Tappan avenue, Belleville, N. J.

Connecticut Association Elects Officers

W. J. Maton, Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., was elected president of the Connecticut Foundrymen's association for 1934-35 at the annual meeting at Meriden, Conn., June 15. Other officers named include: Vice president, B. W. Spencer, Bradley & Hubbard Mfg. Co., Meriden, Conn.; secretary, N. J. Stringer, Charles Parker Co., Meriden, Conn.; treasurer, C. R. Holmes, McLagon Foundry Co., New Haven.

The board of managers includes the officers and the following: C. S. Neumann, Union Mfg. Co., New Britain, Conn.; H. B. Brown, McLagon Foundry Co., New Haven; J. D. Coltman, Bullard Machine Tool Co., Bridgeport; H. S. Washburn, Plainville Castings Co., Plainville, Conn.; Charles S. Parker, the Charles Parker Co., Meriden, Conn.

Head Sales Staff Of Core Oil Producer

J. N. Yaeger, formerly with the Spancer-Kellogg Sales Corp., in charge of sales in the Chicago district, has joined the Certified Core Oil & Mfg. Co., Chicago. Mr. Yaeger has been engaged in the core oil field of the foundry industry during the larger portion of his industrial career, and prior to entering sales work gained practical experience in the core making departments of several foundries.

The Certified company recently has installed additional capacity to its plant, bringing the potential output to 167,000 gallons of its various products. The Maguire Co., Hanna building, Cleveland, and C. V. Law, Mansfield, La., recently were appointed representatives of that company in the respective territories.

Iron Production Up

Production of foundry pig iron in 1933, according to a recent release of the American Iron & Steel institute, New York, was 1,055,622 tons as compared with 811,484 tons in 1932. This represents an increase of 244,138 tons or 30 per cent. Malleable pig iron production increased from 419,723 tons in 1932 to 495,040 tons in 1933, or 17.9 per cent.

Officers Elected By Malleable Society

R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill., was re-elected president of the Malleable Founders' society at the annual meeting held in Cleveland, June 12. John C. Haswell, Dayton Malleable Iron Co., Dayton, O., was named vice president and Robert E. Belt, Cleveland, secretary and treasurer.

The meeting was devoted to the discusssion of problems pertaining to the administration of the code of fair competition of the malleable iron industry. Charles R. Hook, president, American Rolling Mill Co., Middletown, O., spoke at the luncheon meeting on "Employes Representation Plans."

Forming Chapter Of Nonferrous Group

Initial step in the formation of a metropolitan chapter of the Nonferrous Foundry Association for Industrial Recovery was taken at New York July 2. Sam Tour, executive secretary, of association, presided and outlined various advantages that might accrue under the operation of such a chapter.

The organizing committee, which held its first meeting on the evening of July 6, at the offices of the executive secretary of the association, is made up of B. Tamaroff, Trojan Brass Works, Brooklyn; C. A. Martin, Wilman Bronze Foundry Co., Brooklyn; M. Freedman, Bronx Brass Foundry, Bronx; P. A. Portamaroff Co., Manhattan Foundry Co., Manhattan; and Jacob Safer, Brooklyn Foundry Corp., Brooklyn.

Among the objectives are a standard classification of castings, as to intricacy and weight; uniform terms of payment, uniform wage rates, and standard cost accountin. Mr. Tour declared that the association was working on a standard cost system which would probably be ready for submission for the approval of Washington within a few weeks.

Relative to a standard classification of castings, Mr. Tour said that the associatiton has developed a tentative schedule, which is now being tested in three foundries in various sections of the country. The proposed new chapter will be supplied with copies for the consideration of the members. The proposed local chapter will have to begin with close to 30 members companies, out of an estimated total of 65 in the district.

Detroit Foundrymen's association held its first golf tournament of the season on Thursday, June 21, at the Sunnybrook golf club.

ADVERTISING PAGES REMOVED

Building Machine Tool Patterns

(*Concluded from page* 13)

the loose pieces being hardwood or metal. The grain of the wood of the lagging is perpendicular to the plate side of the box and the whole is glued and screwed together and reinforced with bolts. In addition, the top or plate side of the corebox is faced with sheet steel cut to the outline of the core and screwed to the top of the box to take the wear and prevent the box from becoming worn and out of shape on its top edge.

Class *D* patterns are of least expensive construction and involve using second grade pattern pine, paper fillets, nailed construction and serve only to produce the one casting called for.

Lay Out and Divide Work

The actual pattern construction begins by assigning the layout and responsibility to a first-class patternmaker, who is given several other first-class men to assist him. They select and rough out the necessary lumber to frame up the pattern and the major coreboxes and then the group divides, each man working on a major part by himself in co-ordination with the others. The minor or trimming coreboxes are made by second class men after the pattern has progressed far enough to have core prints fixed to it. This co-ordinated effort of a group of men results in a rapid method of building the equipment and, to a large degree, assists in eliminating errors, since the men constantly corroborate figures they are working with.

After the patterns and coreboxes are completed, the pattern is sanded carefully, screw holes are plugged with wood plugs, metal trim is added and the pattern and coreboxes are given a prime coat of shellac, black for the outsides of pattern representing metal and the inside of core boxes, red for core prints, yellow for the seats of loose pieces, etc.

Pattern and coreboxes next are checked carefully for dimensions and accuracy by patternmakers who had nothing to do with their construction. This makes for increased accuracy, as these men take no dimensions for granted, but carefully check and recheck all parts of the equipment to see that they meet the engineering specifications. They also must see that there will be no interferences in the mold in setting the cores made from the core boxes.

The pattern number on a stenciled zinc tape now is tacked to the pattern and coreboxes by the checker. In addition, each corebox and loose piece is marked with an identifying number.

A pattern storage record card is filled out by the checker giving the flask size required for pattern as determined by foundry supervisor, whether the pattern will be mounted or not mounted and the mounting details, the number of coreboxes and the number of loose pieces on the pattern, as well as the number used in the coreboxes. This record is made out in triplicate. One copy is kept in pattern shop files, one copy is sent to the production department files and the card form is sent to the pattern storage to be kept in their files and to be marked up with the location of the pattern and coreboxes as they are stored away after use. There is also an *IN* and *OUT* column on this card for the future dates the pattern is sent from storage to foundry for use and the date of its return.

After the final checking, the pattern, if of Class *A* construction, is mounted permanently on a pair of wood boards or on standard steel plates, illustrated in Fig. 2, which conform to the sets of standard steel flasks and methods of ramming used in the foundry. Class *A* large coreboxes are fitted with bolt lugs for bolting them to the tables of the jolt-roll-over machines used for making large cores in the core room. Patterns of such construction not to be mounted are pinned together with the conventional pattern pins. Then, the patterns are given the final coats of shellac or lacquer with careful sandings between coats and are sent to the pattern storage to be held until needed for use.

Grouped According to Size

Pattern storage facilities are modern and complete, as illustrated in Fig. 3. The building is of fireproof concrete and brick construction, four stories high, sprinkled and heated. A large freight elevator transports the patterns from the various floors.

Patterns are grouped together in the building according to size. For example, on the first floor are stored, in addition to pattern lumber and extra standard pattern plates, all the larger mounted patterns. On the second floor are all the mounted squeezer and green sand jolt machine patterns, in addition to some loose work and mounted milling machine tables. The third floor contains mounted jolt machine patterns for dry sand molds and on the fourth floor, are all the single patterns of Class *C* and *D* construction. Location areas are clearly marked by signs and an accurate record of the location of each pattern is kept on the pattern storage record card in a filing cabinet. The records are referred to each time a pattern is removed from the storage for any purpose and the date of removal stamped in the *OUT* column on record card. Similarly, when the pattern is returned, the card gives the storage location and is stamped with the date returned in the *IN* column. A crew of trained men handle patterns carefully, place the patterns in the storage, remove them for use in the foundry and transport them to and from the various molding departments and the core room.

Patterns Treated with Care

Pattern maintenance can become an expensive item, if pattern equipment is not handled carefully. In the foundry, patterns are brushed off after use and each night carefully wiped off to remove traces of adhering oil and sand. Patterns are wiped off and inspected carefully when returned to storage. If serious defects, such as dents, cracks or peeling paint are discovered, the pattern storage supervisor either has the pattern repaired immediately or else tags it with a tag with two detachable stubs. Both stubs filled out with the essential information are sent to the production department and kept on file. When castings are again wanted from this pattern, the production department file shows that pattern must be sent to pattern shop in advance of molding date for repairs. This is handled by sending the stub labeled *Pattern Shop* from production department to the pattern shop supervisor who orders the pattern into the pattern shop and notifies production department when repairs are completed.

These tags with detachable stubs are also used in the same manner for having pattern defects corrected as discovered in the foundry or machine shop. This furnishes a constant check on conditions.

Coreboxes are brushed and blown out after making each core and carefully wiped out at night. The pattern storage men inspect coreboxes when returned from the foundry and rejects are handled in the same manner, as patterns.

Periodic repainting of patterns and coreboxes in production not only facilitates molding and coremaking, but preserves the wood and, at the same time, presents an opportunity for waxing out small surface imperfections gradually accumulating in them. This results in a casting which more closely fulfills the rigid requirements of the products made by the company.

Opens Branch Offices

Climax Molybdenum Co., 295 Madison avenue, New York, has opened branch offices in Chicago and Canton, O. The Chicago office, located in the Straus building at 310 South Michigan avenue, will be in charge of E. R. Young. The Canton office, located in the First National Bank building, will be in charge of Paul M. Snyder.

Humidity Affects Core Strength

(*Concluded from page* 15)

ing a variation of about 15 per cent.

Results shown in the various tables indicate that high humidity does decrease the core strength. Since the air in a closed mold is saturated with moisture—100 per cent humidity—we would expect the strength of cores to decrease rapidly in a close mold. This expectation was verified by placing standard tensile test core specimens on chaplets in a closed mold. These specimens were removed and tested at regular time intervals. Results of these tests are shown in Figs. 1 and 2 and in table V. Attention is directed to the fact that the greatest loss of strength occurs during the first hour the core is in the mold. Obviously where core strength is at a premium, the mold should not be closed until just before the metal is ready to be poured into it.

Investigate the Strength

Strength of different parts of large section cores was investigated. Baking characteristics of raw linseed oil and raw soy bean oil are shown respectively in Figs. 3 and 4. These charts show that for each temperature there is a definite baking time that gives maximum strength. Where these curves are used to predict the baking characteristics of large cores the following results might be expected: The outer surface of a large core will reach the baking temperature first and therefore will be the first part to reach maximum strength. If the temperature is maintained the inside will continue to bake until finally it reaches maximum strength. By that time the outer surface will be over baked with a consequent loss in strength.

For oils which dry by a process of oxidation the problem not only is one of raising the center of large cores to a baking temperature, but of introducing oxygen to the center of the core. Therefore the rate at which the center increases in strength depends upon the temperature and the permeability of the sand.

To obtain a measure of the temperature gradient inside a large core during the baking period, a number of test cores were prepared as solid cylinders 4 inches in diameter and 4 inches high. Thermocouples were placed in the cores at three points, at a height of 2 inches above the core plate. The first rested in the center of the core. The second was placed half way between the center and the surface and the third was in contact with the surface. The cores were placed in an American Foundrymen's association standard core oven at 400 degrees Fahr., and temperature readings were taken on the three couples at regular time intervals. Cores were made with both oils mixed in the proportion of 100 parts sand to 1 part oil and with 1 and 6 parts water.

Results for linseed oil bonded cores are shown in Figs 3 and 4. Since practically the same results were secured on the cores bonded with soy bean oil the curves are omitted. The curves show that during the heating period there is a very appreciable lag in the temperature of the inside of the core. This temperature lag is even more pronounced in the mixture containing the most water. The temperature remains constant at the boiling point of water for a period sufficient for evaporation. Naturally, this feature increases the time necessary to raise the entire core to a uniform temperature.

Effect of these various factors on core strength was measured. Additional cores of the size previously described were made up and baked for varying periods. The cores were cut into sections so that three American Foundrymen's association standard tension test cores could be made from each large core. One test specimen was taken from the top, one from the center section and one from the section adjacent to the core plate. Duplicate cores were dried upon solid and upon perforated core plates.

Vary As Expected

Results are shown in Tables I and II. In a general way it may be noted that the strengths vary in a manner that might be expected. The maximum strength was attained first on the surface and then as the baking time continued the strength moved toward the center. The outer part lost strength to a corresponding extent as the center gained. Due probably to the better circulation of air the variations in strength are not so pronounced in the cores dried upon the perforated plates.

From the foregoing experimental data the authors conclude that cores stored in a highly humid atmosphere suffer a loss in strength which can be regained only to a partial extent by redrying, also that cores standing in a green sand mold for an hour or more lose about 50 per cent of their strength. Cores of large cross section do not bake uniformly throughout, therefore the baking time must be arranged with this feature in view.

The total number of unemployed workers in March, 1934, was 8,021,000, according to an estimate of the National Industrial Conference board. In March, 1934, unemployment showed a decline of 589,000, as compared with February, 1934, and a decline of 5,182,000, or 39.2 per cent, as compared with March, 1933, when unemployment was at its highest point.

Scores Hole-in-One At Annual Foundry Outing

Annual outing of the Pittsburgh Foundrymen's association was held at Pathe Wildwood Country club, Glenshaw, Pa., near Pittsburgh, on June 18 and although a steady rain reduced the number of those playing golf, an enthusiastic turnout of over 100 was present with several additional joining the group for dinner held that evening at the Wildwood clubhouse.

A feature of the afternoon's golf, in which about 40 participated, was a hole-in-one made on the 128-yard fourth hole by Richard H. Stone. Witnesses to Mr. Stone's feat were A. R. MacGregor and E. A. France Jr., both of whom were playing with Mr. Stone.

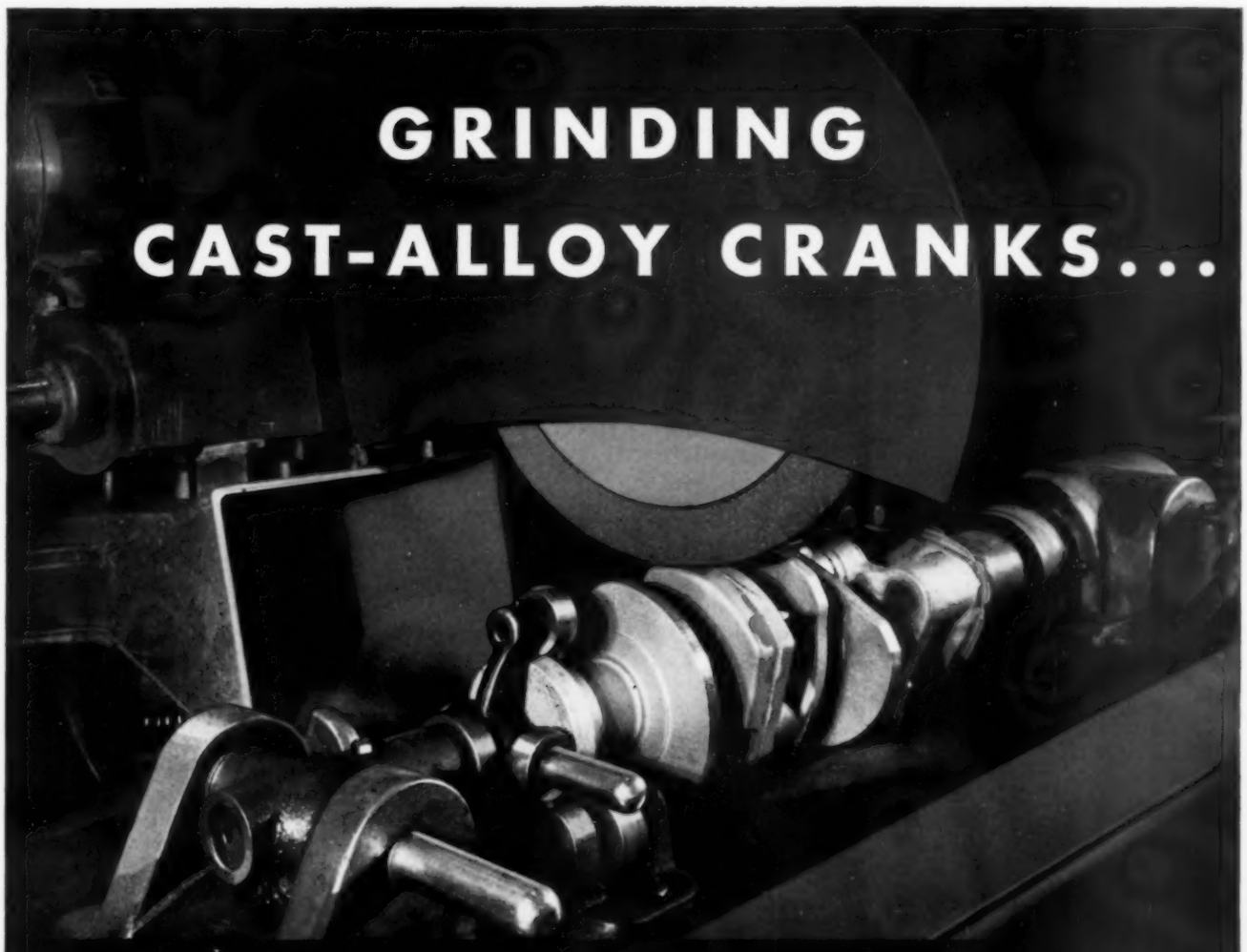
Full 18-hole scores were high owing to the sodden course and heavy rain which was uninterrupted all afternoon but William Bolmer won low gross with an 89. E. A. France Jr. was second low with 91. High gross for the day was recorded by W. J. Charles with a score of 154. Prize in the blind bogey sweepstakes went to J. B. McConnell with a net score of 80 after deducting his 25-stroke handicap from a gross score of 105. Tied for second low in this event were William Bolmer, George Day and W. H. Nichols, all with net 77. Low net for the tournament was turned in by M. M. Smith who had a 69 after deducting of a handicap of 65 strokes.

Is Appointed Development Engineer

D. A. Nemser, formerly chief metallurgist, Pratt & Whitney Mfg. Co., Hartford, Conn., has been appointed development engineer of the International Nickel Co., with headquarters at Hartford, Conn.

Mr. Nemser graduated from the Carnegie Institute of Technology, Pittsburgh, in 1919 with a degree of bachelor of science in chemical engineering. Prior to joining the metallurgical staff of Pratt & Whitney, he was associated with the Atlas Steel Corp., Dunkirk, N. Y.; MacBeth-Evans Glass Co., Charleroi, Pa.; and the Henry Southern Engineering Co., Hartford.

GRINDING CAST-ALLOY CRANKS...



or MATCHING STRIDES *with the* AUTOMOBILE INDUSTRY

HERE too is a new grinding condition presenting new grinding problems—the grinding of bearings and pins of cast-alloy cranks—cast from a steel alloy of special analysis—having unique metallurgical characteristics—a lighter, stronger shaft—longer wearing—longer lived—that increases fuel economy because of perfectly ground bearing surfaces and the lightness of the material.

Carborundum Research and Carborundum Brand Wheels met the new grinding conditions.

Going to finer grits and harder grades resulted in much finer finishes—yet so adequately do the wheels meet the conditions that production—finish—accuracy—all are assured.

On bearings, the Carborundum Brand Wheels remove .050 inch of stock—grind 65 shafts per dressing—hourly production, 50 shafts. On throws, 1000 shafts per wheel, 10 to 11 shafts per hour, removing .040 to .055 inch of stock.

And the wheels hold up on the radii and corners.

Here again is an example of Carborundum service to a great industry—of the ability of Carborundum Research to put the right wheel in the right place.

A service available to all plants, large or small, in the solving of any grinding problems.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N.Y.

Canadian Carborundum Co., Ltd., Niagara Falls, Ont. Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Milwaukee, Grand Rapids; Toronto, Ont. (Carborundum and Aloxite are registered trade marks of The Carborundum Company.)

Report on Research Projects

(*Continued from page* 17)

bearing on the more fundamental work of the committee, work of a broader and less specialized nature than that of the still tube subcommittee, were brought to a more definite stage. Among these is the procurement and distribution of a carbon steel carefully checked as to uniformity, which laboratories may use for better comparison of their short time and creep results. Another is the drawing up of a plan, to be submitted to letter ballot of the committee, which, in case of approval, will result in starting of experiments at an early date for creep tests on one or more materials, at one or more temperatures, the tests to be carried out for at least 20,000 hours. This is to establish the relationship between the curves so obtained and the extrapolations of shorter tests of, say, 1000 hours, or of the various so-called accelerated tests.

Authorize Further Work

An extension of the previous work on 18-8 also was authorized, aimed to throw light on the experimental fact that one lot used, although containing no stabilizing element was found not to be embrittled after sojourn at elevated temperature under load for 1000 or 1500 hours. The question whether it passed a brittle stage, without any perturbation of the creep curve to evidence it, and subsequently recovered, will be examined.

A subcommittee on effect of temperature on metal to metal wear, covering such phenomena as seizure, as encountered in valves, operating at high temperatures, has made a preliminary study of the problem and will proceed to a further study, in the hope of supplementing the present empirical knowledge by a more fundamental understanding.

A new subcommittee, on effect of subzero temperatures, is to be appointed to correlate and present data which many of the committee members are securing as a result of the interest of the oil industry in steels most suitable for use at the very low temperatures of some modern de-waxing processes.

An important milestone in the development of heat treatment control in connection with 5 per cent chrome steel still tubes containing ½ per cent molybdenum was discussed by a joint paper on creep properties of such tubes. This was submitted by Howard W. Cross, Battelle Memorial Institute, the joint effort of Mr. Cross and E. R. Johnson, Republic Steel Corp.

Dr. H. F. Moore reported that the research committee on fatigue of metals has asked one of its members to draw up a preliminary statement of practice for rotating-beam fatigue tests, and plans to consider the question of recommended test methods with such a proposed outline of recommended practice before it as an example. The main desire at this time is to provide a basis which will make possible comparison of work which is being done by different laboratories.

Dr. Moore also reported that several members of the committee are carrying on tests to determine a *damage line* for different metals. Damage in this sense is measured by the reduction of endurance limit of metal subjected to a given combination of stress and number of cycles below the endurance of the virgin metals. That is, it locates combinations of stress and number of cycles below which no apparent damage is done to a given metal.

P. G. McVetty, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., submitted a paper on the interpretation of creep tests. His discussion was aimed at the design engineers who are confronted with the need for specifying metals that will meet operating requirements under high temperatures.

G. N. Krause, University of Illinois, described a new high-speed fatigue machine and gave data on some tests made with it. In the case of duralumin, Richard L. Templin, Aluminum Co. of America, objected to Mr. Krouse's results, saying his laboratory tests showed duralumin to be stronger than the machine had indicated.

Reports on Die-Casting

Committee B-6 reporting at the Thursday night session on die-cast metals and alloys, received from the subcommittee on zinc-base die-casting alloys, a recommendation that the aluminum content of alloy No. 23 in the tentative specifications should be reduced from 4.50 to 4.30 per cent maximum; also that 0.015 to 0.03 per cent nickel be allowed in this alloy. This report was accompanied by an appendix comprising a voluminous study, by E. A. Anderson and G. L. Werley, New Jersey Zinc Co. on the effects of varying aluminum content in this alloy.

A report recommending a proposed tentative standard specification for magnesium-base alloy die casting also was received by committee B-6 for publication. One alloy is specified, being known as alloy No. 2. It may be made from virgin metal or from purified scrap metal of known composition. Composition should be: Magnesium, minimum, 88 per cent; aluminum 9 to 11 per cent; manganese 0.10 minimum; copper 0.10 maximum; nickel 0.05 maximum.

Following the report of committee B-6, E. A. Anderson read a report, prepared by him in conjunction with G. L. Werley, on the impact strength of commercial zinc alloy die castings.

Certain changes in the three grades of lead covered by the standard specifications for pig lead, B 29-23, were reported to committee B-2 by subcommittee 1. They will be submitted by letter ballot to the members of committee B-2 and, if approved, will be presented to the society through committee E-10 on standards. The revisions which the subcommittee reported includes a revised scope clause and changes in chemical composition of the three grades of pig lead covered by the standard specifications. The changes apply to the composition of corroding lead, chemical lead, common lead known as Grade 3, and common lead known as Grade 3-A.

In response to requests from the industry, committee B-7 during the past year has submitted to the society, through committee E-10 on standards, one new tentative specification, five tentative specifications proposed as revisions of existing standards and a revision of one existing tentative specification.

Submit Tentative Specifications

Titles of these tentative specifications are: Manganese ingot and stick for remelting; aluminum sheet and plate; aluminum-base alloy sand castings; aluminum-base sand-casting alloys in ingot form; aluminum-alloy (duralumin) sheet and plate (aluminum-copper-magnesium-manganese); aluminum-manganese alloy sheet and plate; aluminum-alloy (duralumin) bars, rods and shapes (aluminum-copper-magnesium-manganese).

E. H. Dix Jr., Aluminum Co. of America, New Kensington, Pa., of committee B-7, submitted a report on "Service Characteristics of Light Metals and Their Alloys." The purpose of this report was to give the designing engineer and the metal consumer an accurate and concise picture of the light metal industry.

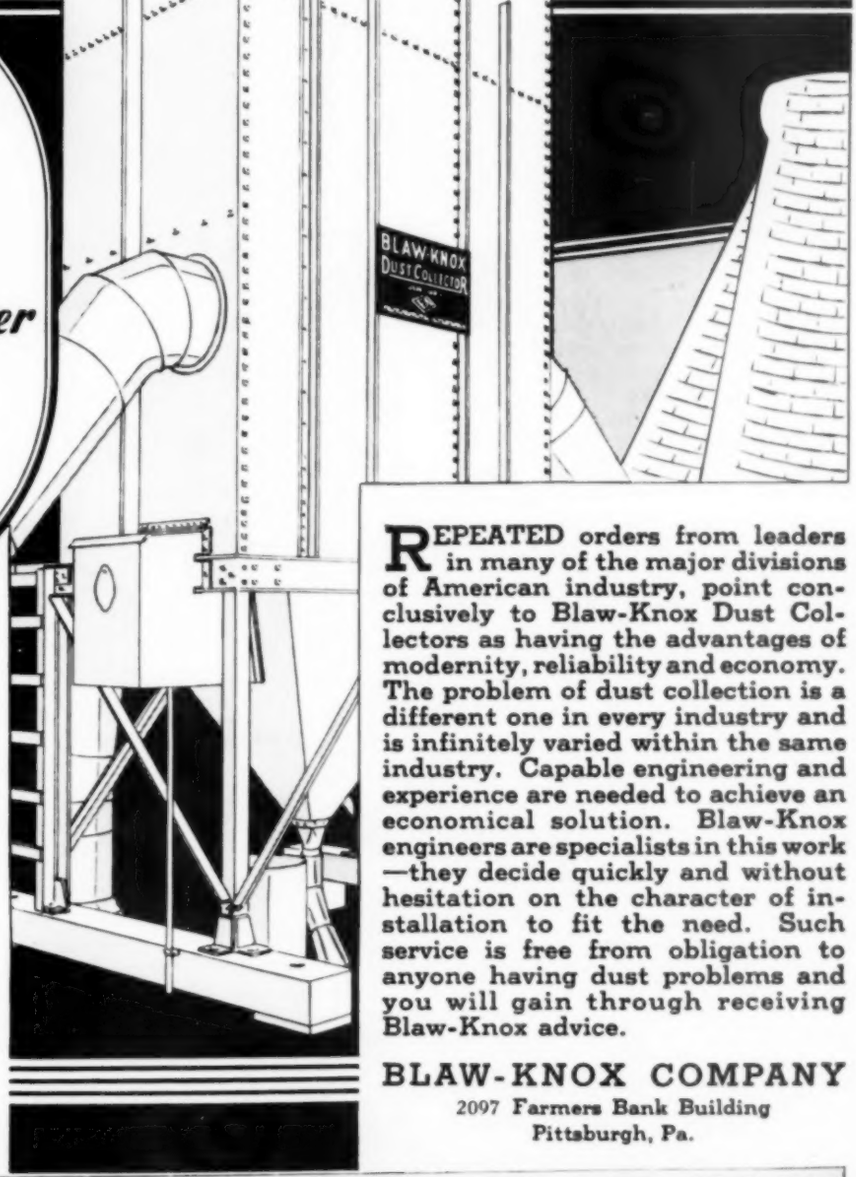
Committee E-4 on metallography reported that its subcommittee 1 has drafted a proposed revision of the standard methods of metallographic testing of iron and steel, and also of the methods of metallographic testing of nonferrous metals and alloys. This committee is preparing to appoint a subcommittee to study structure and grain size of tool steels.

W. H. Swanger, National bureau of standards, Washington, submitted a paper describing expansion fits. Where it is not practicable or permissible to heat a ring, for instance, which ordinarily would be shrunk on a pin, a reverse method is employed. The pin may be contracted by cooling and inserted into the ring, which will grip the pin tightly, and occasionally seize, when the pin comes back to normal temperature. By adding dry ice to a

(*Concluded on page* 46)

BLAW-KNOX DUST COLLECTORS

INDISPENSIBLE to INDUSTRY as the Vacuum Cleaner is to the HOME!



REPEATED orders from leaders in many of the major divisions of American industry, point conclusively to Blaw-Knox Dust Collectors as having the advantages of modernity, reliability and economy. The problem of dust collection is a different one in every industry and is infinitely varied within the same industry. Capable engineering and experience are needed to achieve an economical solution. Blaw-Knox engineers are specialists in this work—they decide quickly and without hesitation on the character of installation to fit the need. Such service is free from obligation to anyone having dust problems and you will gain through receiving Blaw-Knox advice.

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BLAW-KNOX

(*Concluded from page* 44)

bath of acetone, metal may be cooled down to 70 to 80 degrees below zero, Cent. Discussion revealed that the Aluminum Co. of America already uses this method in making joints in aluminum flagpoles, etc.

"Some Factors Affecting Strain Measurements in Tests of Metals," was the title of a paper submitted by R. L. Templin, Aluminum Co. of America. Committee A-5 expects before the end of this year to prepare recommended tentative specifications for corrosion-resisting castings. Specifications for corrosion-resisting bars and forgings also are being planned. A round table is to be held by this committee at Philadelphia next March to deal with troubles in the fabrication of these alloys.

K. H. Logan, National bureau of standards, submitted a paper on the "Use of Bureau of Standard Soil Corrosion Data in the Design and Protection of Pipe Lines." He warned that the solution of the problem of economically reducing such corrosion is incomplete, and that the bureau does not believe that the study has been advanced to a stage at which sound conclusions can be drawn. Mr. Logan intimated that existing ideas as to pipe protection probably will bave to be revised. It appears that asphalt coatings on pipe enable the pipe to form a protective film of its own, so that after the asphalt loses its effectiveness as a protective coating, the pipe is found to be free of the pitting which characterizes uncoated pipe placed underground. Mr. Logan mentioned cases where even cast iron pipe seems to have been completely corroded in soil and yet the pipe line stays open, evidently being supported by walls made up of the products of corrosion. In the discussion on this paper it was stated that there is little variation in the soil-corrosion resistance of such materials as steel, wrought iron, cast iron and stainless steel. Even stainless steel, under the attack of soil, shows pitting. But it was made clear that reports of soil corrosion are exaggerated. It was said that less than 10 per cent of the pipe placed underground needs protection. This is due to the different effects of different soils.

The eighth award of the Charles B. Dudley medal, commemorating the first president of the society was awarded to R. L. Templin, Aluminum Company of America, New Kensington, Pa. This was in recognition of his contribution to scientific knowledge, through his paper on the fatigue properties of light metals and alloys, presented at the 1933 annual meeting.

The announcement of the election of officers and members of the executive committee was made by Prof. H. S. Moore. These were as follows: President, W. H. Bassett, American Brass Co., Waterbury, Conn.; vice president, H. S. Vassar, Public Service Electric and Gas Co., Irvington, N. J.; members of the executive committee, H. A. Anderson, Western Electric Co., Chicago, H. J. Ball, Lowell Textile institute, Lowell, Mass., W. M. Barr, Union Pacific Railroad Co., Omaha, Nebr., L. S. Marsh, Inland Steel Co., Chicago, and J. B. Rather, Socony-Vacuum Corp., New York. The newly elected officers and members of the executive committee, with the exception of Mr. Bassett, who was absent due to illness, were presented at a reception to the membership of the society.

Discuss Administration of Code of Gray Iron Foundry Industry

INDICATING a stable labor situation in the foundry industry, Henry M. Halsted Jr., executive vice president, Gray Iron Foundry code authority, told members of the New Jersey Foundrymen's association June 24 that no labor disturbances have been referred to the code authority since its organization 4½ months ago.

The remark was made at the annual dinner meeting of the association at the Hotel Elton, Newark, at which the speaker and Franklin R. Hoadley, vice president of the Farrel-Birmingham Co., Ansonia, Conn., president of the code authority of the gray iron industry and member of the durable goods committee, led the discussion pertaining largely to Washington and code matters.

Early approval by NRA of a cost accounting plan for the industry and of a list of fair trade practices was expected, according to Mr. Halsted. The wage rate question, he said, was complex and would require further study by members generally.

One of the many problems confronting the code authority staff is the development of comprehensive data on all gray iron foundries scattered throughout the country. So disrupting has been the effect of the depression over the past few years, Mr. Halsted said, that it is difficult to establish the exact status of many companies in the industry. Some virtually have passed out of existence; others have been closed down for considerable time, with future plans uncertain. Still others have been slow in co-operating with the code authority, with a result that it has been difficult to get statistics in as complete shape as desirable.

Of special interest to the jobbing founders present was the statement by Mr. Hoadley that many manufacturing companies, owning foundries and which early in the depression went after jobbing business to augment their own slacking demands upon those units, since have withdrawn from jobbing, as they found it unprofitable.

Discussion as to code assessments, brought out the fact that while more than 1800 foundries were on the code authority's mailing list, approximately 645 actively were supporting the code. Mr. Halsted believes that after the investigation as to the status of various companies is completed, the mailing list can be materially reduced. Gray iron founders are being assessed far less than steel and malleable founders, it was stated.

Mr. Hoadley, giving an intimate picture of the situation in Washington, as he has been able to observe it, fixed March 6 as an important date for industry and business. It was then that the durable goods committee was formed, and that the heavy industries generally for the first time became truly vocal with respect to their opinions as to the trend of affairs in Washington. There is a great deal yet to be desired, he said, but since that date much has been accomplished in forestalling fallacious legislation and in developing a turn of action, which he believes is going to be beneficial. He emphasized the need for men, as individuals, to register their opinions with official Washington, not confining their telegrams and letters alone to congressmen.

Importance was laid on the desirability of having paid secretaries in various districts, with the accomplishment of the New Jersey Foundrymen's association under such a secretary referred to as a highly desirable goal.

Directors elected by the New Jersey association are as follows:

For 3 years: Walter H. Cole, Moore Bros. Co., Elizabeth; H. L. Edinger, Barnett Foundry & Machinery Co., Irvington; William H. Mantz, Atlas Foundry Co. Irvington; David L. Sacks, Sacks-Barlow Foundries, Inc., Newark; Joseph T. Smith, North Jersey Foundry Co., Paterson.

For 2 years: William D. Goldsmith, C. A. Goldsmith Co., Newark; William P. Laytham, William P. Laytham & Sons Co., Paterson; Robert E. Moore, Flockhart Foundry Co., Newark; John C. Phelan, Benjamin Eastwood Co., Paterson; W. H. Winters, American Brake Shoe & Foundry Co., Mahwah.

For 1 year: J. Robert Campbell, Campbell Foundry Co., Harrison; George Farrell, Snead & Co., Jersey City; J. W. Reid, Robins Conveying Belt Co., Passaic; A. G. White, White Foundry Co., Jersey City; J. A. Williamson, Isbell Porter Co., Newark.

ADVERTISING PAGES OMITTED

Studies Cast Red Brass

(*Concluded from page 20*)

tionable in sand-cast bars. The adverse effect of pouring temperatures above 1205 degrees Cent. was not so pronounced in the chill-ingot and other bars as in the sand-cast bars.

8. The relatively wide variation in the physical properties of different types of test bars obtained from the same heat of metal forcibly emphasies the need for a standard method for obtaining the test bars. In many respects the sand-cast bars were not so suitable as those obtained by other methods.

Conclusions

INTERESTING results of the second phase of an investigation, which was sponsored by the Non-Ferrous Ingot Metal institute at the bureau of standards to collect data to be used in the simplification of the number of compositions of copper-base ingot metals, are presented in this article. Test procedure and a discussion of the properties of the alloy made from virgin metal and from remelted metal were presented in the June issue of The Foundry, beginning on page 20. The two articles are from the annual exchange paper of the American Foundrymen's association to the institute of British Foundrymen. The author is physicist, United States bureau of standards, Washington.

Chicago Chapter Of A. F. A. Elects Officers

Chicago Foundrymen's club, now the Chicago section, American Foundrymen's association, held its last meeting of the fiscal year at the Great Northern hotel, June 7. While the club is surrendering its incorporate charter, granted by the state of Illinois in 1912, it will continue its activities largely as heretofore under its new affiliation with the American Foundrymen's association. The Chicago group is the first local chapter to receive a charter from the parent body.

D. J. Reese, Whiting Corp., Harvey, Ill., was elected chairman of the Chicago section for the coming year. Other officers chosen include: Vice chairman James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind.; secretary, W. C. Packard, National Engineering Co., Chicago; treasurer, C. C. Kawin, C. C. Kawin Co., Chicago. Members selected for the executive committee are: W. C. Cureton, W. A. Jones Foundry & Machine Co.; G. L. Cherry, Western Electric Co.; L. G. Wise, Chicago Malleable Castings Co.; J. R. Allan, International Harvester Co.; D. E. Clifford, Hickman Williams & Co.; W. H. Parker, American Steel Foundries; J. J. Boland, Griffin Wheel Co.; and V. E. Flodin, Crane Co.

The technical program of the meeting consisted of a talk by W. R. Bean, vice president, Whiting Corp., on "Outstanding Recent Developments in the Manufacture, Metallurgy and Application of Malleable Cast Iron." Mr. Bean spoke briefly on important phases of this subject, leading subsequent discussion on a variety of practices in the malleable industry. The speaker pointed out that a place exists in industry for a weldable malleable iron, such castings to have a low carbon content to prevent undue hardening when heated above the critical temperature of ordinary malleable iron.

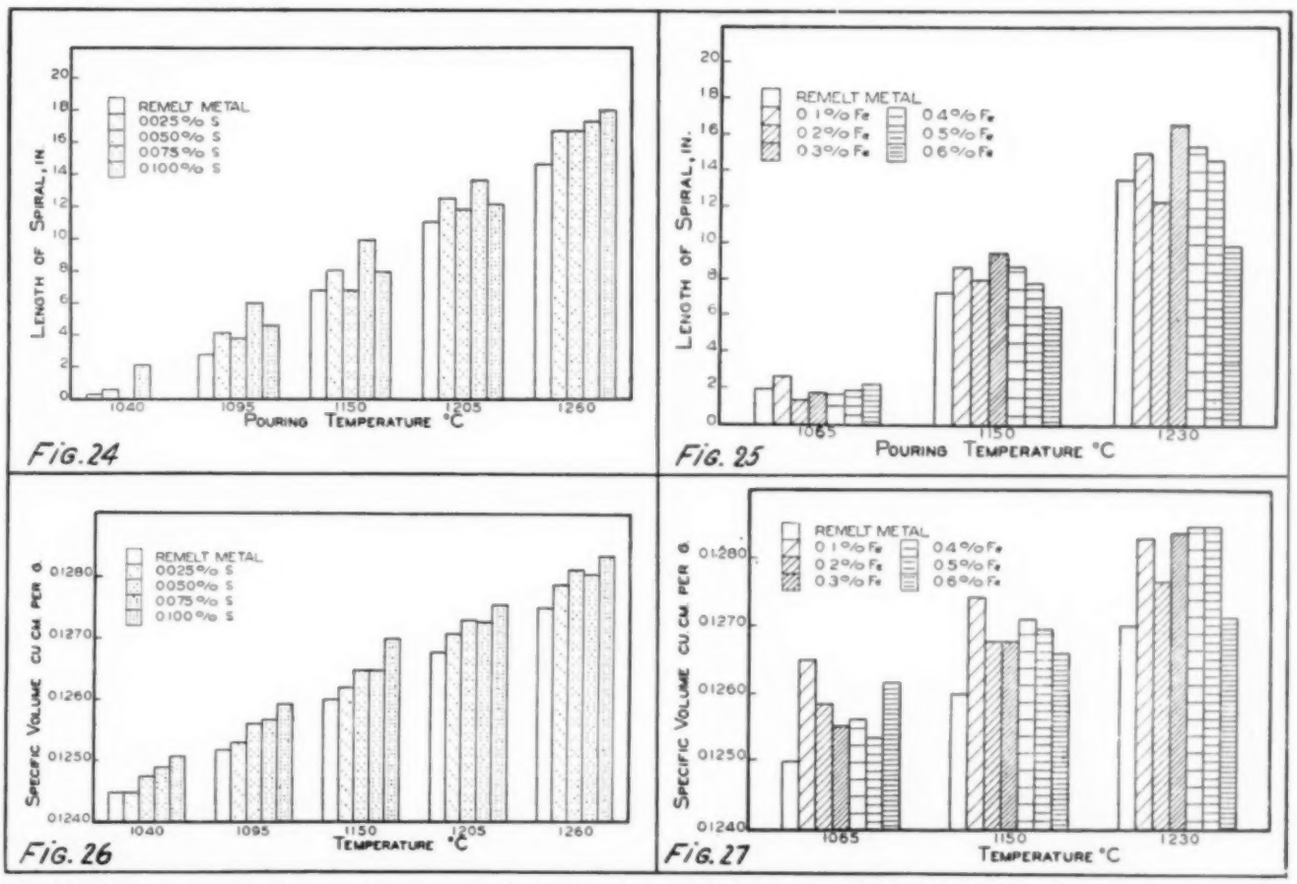


Fig. 24—Effect of pouring temperature on running properties of red brass containing sulphur. Fig. 25—On running properties containing iron. Fig. 26—On specific volume of brass with sulphur. Fig. 27—On specific volume with iron

Probably has forgotten half the items

The Adventures of Bill

BY PAT DWYER

ON ONE of these hot nights recently Bill removed his coat, settled back luxuriously in his chair, elevated both feet to the veranda railing, thus exposing about 6 inches of socks in a violent tartan pattern and exhaled a gentle sigh of relief. These various actions were performed in the order indicated and with a perceptible pause or time interval between let us say *A* and *B*, *B* and *C*, and *C* and *D*. In other words—a totally unnecessary phrase and one merely thrown in through force of habit—the entire performance might have passed for a rather neat pantomime of Stevenson's alliterative "Hunter home from the hill and the Sailor home from the sea." My brief comment on this point served to show me that although Bill might be tired and hot physically, the old mental engine was revolving at the usual number of r.p.m.

"The hunter home from the hill, eh? Say, young feller me lad, let me tell you them were the good old days when the hunter was left to his own devices in bringing home the bacon. He was not hampered and hindered and bedeviled by a mess of rules and laws and regulations, telling him where and how and when he should seek his game, what weapon he should use on certain days of the week, what style of ammunition he should employ, or what help he should engage if necessary in dragging the meat to the old fireside. The result of his labor was his own to be shared with his family or given to his friends. He did not have to wrap up all the choice cuts and humbly offer than to a bunch of fat lads in grateful recognition of their efforts in telling him what he should and should not do."

"Quite true, Comrade Bilinski" I admitted "Quite true. Those indeed were the good old days when every man was his own boss and was free to provide for his own material wants to the best of his ability and skill. However, in your most rabid moments you must admit that the system or lack of system would not work in our present complex civilization. Certain laws and regulations must be observed and enforced to keep the industrial, economic and commercial world from disintegrating and flying to pieces."

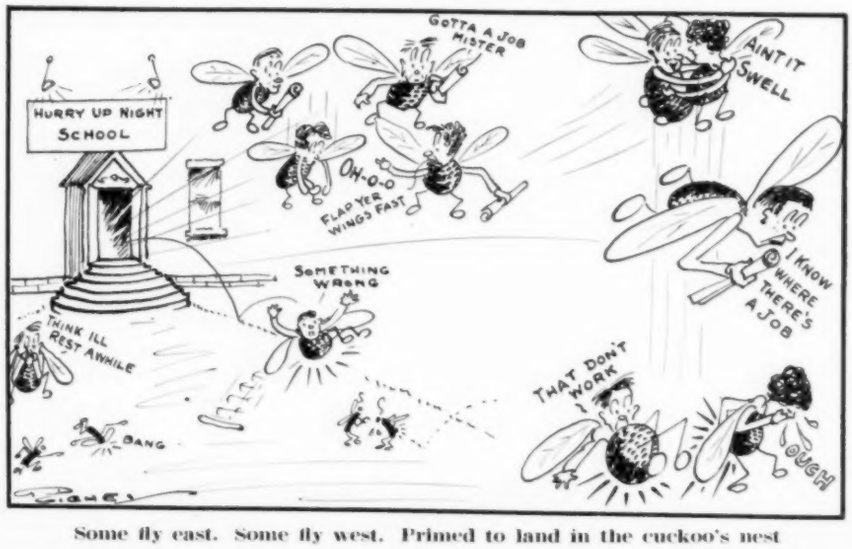
"Well" said Bill "I'll tell you. The basic idea of regulating human conduct and activities in its myriad ramifications, is sound and sensible. As with many other basic ideas the weak point is found in the human element. In many instances the laws are framed by men who lack a comprehensive knowledge of the problem involved. In a greater number of instances the interpretation and administration of specific laws are entrusted to the hands of men with even a more limited knowledge of the subject.

"The third and most important stumbling block in the way of carrying out any law, is that eminent members of the legal fraternity will uphold the contention of either plaintiff or defendant, irrespective of any moral principle involved. Through some peculiar process of mental legerdemain, a lawyer for the plaintiff can shelve his own sense of right and wrong, ignore all the evidence in favor of the defendant and valiantly try to prove that his client is a deeply wronged party. In the same case and from the same evidence the lawyer for the defendant will prove that his client is a model of rectitude and righteousness and that the plaintiff and his lawyer are a pair of spotted hyenas, if he cannot think of a more odious comparison.

"Of course all litigation is grist for the mill of the lawyer-millers. They are paid for their services, win, lose or draw. Modern Hessians, ready to fight under any flag so long as their wages are paid. They are not interested in abstract principles of right or justice or in any attempt to apply the Golden Rule. The world is a battle field with every man trying to grab something away from his neighbor. The job of the highly gifted legal boys is to help the grabber to grab all he can, or conversely, prevent some other grabber from taking what he already has accumulated."

"The new deal" I said "will help to clarify the situation. With rigid rules, regulations and codes governing every form of activity, the problem of litigation, at least in the industrial field should be reduced to a minimum."

"My dear lad, you really should



Some fly east. Some fly west. Primed to land in the cuckoo's nest

creep out of your igloo once in a while to see and hear what is going on. Thousands of manufacturers who participated in the preparation of the various codes are prepared to carry on in strict accordance with the letter and the spirit. Unfortunately, other thousands, either with or without the assistance of expert legal help are engaged in boring or discovering convenient loop holes in the various codes through which they can wiggle out of complying, or through which they can sink a poisoned fang into a competitor, an employe or an employer. The new deal has poured oil on the former industrial troubled waters, but the discontented boys are beginning to drop lighted matches here and there.

"Fire laddies from Hook and Grabber No. 1 will be called out in gradually increasing numbers and may be counted upon to bring a full array of technicalities, torts, malfeasance and one thing and another to prevent the flames from dying down prematurely.

"Eventually all the available legal talent will be employed and the fires will spread farther and farther. In response to a general alarm, patriotic citizens will erect and endow large schools where a constant succession of ambitious young men will be handled on a mass production basis and transformed into passable legal lights almost over night.

"American ingenuity and resourcefulness never failed yet to meet a crisis. Shall it be said by future generations that the spirit of the old frontier, the spirit of '76, Don't give up the ship and Hail, hail, the gang's all here, shall it be said that the good old spirit was lacking when the nation cried for volunteers to enter the trenches where the alphabetical fights were raging most furiously?

"No, my boy, it shall not be said. Why shall it not be said? For the very simple and sufficient reason that the eyes of every young man in the country will be turned to this potentially lucrative field, even as their eyes were turned a few years ago to the selling field where many young men were paid really handsome honorariums for a minumum of effort either physical or mental.

"Probably you remember the flock of efficiency and other experts which suddenly materialized during the war years and then disappeared something after the fashion of a flock of locusts. Forcing frames and all the other usual impedimenta of the hot house, set up in every town and hamlet before the year is over will be turning out a constant stream of bright and shiny young adjudicators, counselers, experts, judges, umpires, inspectors and expectors. Pausing momentarily to place a few sandwiches in the brief case, each graduate will hop into the fray and try to grab a loose end in the hopeless tangle of alphabetical red tape.

"In the mean time we shall have to keep the old home fires burning and that includes a few words of advice now and again to foundrymen confronted wtih more or less peculiar problems. Recently a man wanted to know where he could secure a book on casting bronze tablets.

Arranging a little gentlemen's agreement

"On account of the large area and the limited thickness of the casting, and also because the mold must be either dried in the oven or skin dried, an iron flask is preferable to one made of wood. However, if no iron flask is available the mold may be made in a wood flask, provided proper precautions are observed to secure rigidity.

"For example, the bottom board must rest upon a firm, level bed. The cope should be provided with a strongback longitudinally on a center line. Chuck bars nailed to the strongback and the traverse bars in the cope will prevent the cope face from rising under the pressure of the metal, thus resulting in a casting thicker in the center than elsewhere. The strongback also will prevent the center of the cope from sagging after the mold is closed. Any sag will reduce the thickness of the mold cavity and thus shut off the metal in whole or in part in that area.

"In this particular instance with a fairly narrow cope, the strongback may be omitted. After the mold is closed a length of steel rail or I-beam is placed on top of the cope and clamped from the bottom board at each end. Small wood wedges are inserted between the top of the cope bars and the lower side of the rail. The lift on a plate 2 x 4-feet under an 8-inch head is approximately 3000 pounds, hence the need of a strong flask, braced on the top and clamped at approximately 1-foot intervals along the sides and ends.

"Under stress of circumstances and assuming a certain amount of risk the casting might be poured from two crucibles, one on either side of the mold. However, more satisfactory results will be secured with four crucibles from which the metal may be poured into four sprues, one near each corner of the flask. Two sprues at each side of the flask discharge the metal into a long continuous channel in the drag face of the mold, about 3 inches from the flask wall and about 1-inch from the casting. The channel is connected to the mold cavity by a number of gates spaced 3 inches apart. Each gate is 2 inches in width and slightly less than the casting in thickness.

"Alternative methods of gating include a number of thin wedge gates on top connected to a single runner and a number of thin gates along one edge with the mold in a vertical instead of a horizontal position. However, both the latter methods apply more particularly to extra large, or extra thin tablets and probably are not needed in the present instance.

"French sand is the ideal material for molding statuary or other ornamental bronze castings. It takes a fine impression, bakes as hard as a brick and yet is so permeable that the metal lies against it quietly. In the absence of this material a sand conforming to the general characteristics of Albany No. 0, will produce fairly satisfactory castings. The facing sand is prepared by adding a small quantity of practically any core binder to the required quantity of dried sand. Where a liquid core binder is employed it may be used in diluted form to wet down the sand to the required working dampness. The facing should be thoroughly mixed and preferably left over night covered with wet bags.

"The pattern is dusted lightly with lycopodium or other parting powder and then covered with facing from a No. 10 riddle. Some foundrymen prefer to hold the riddle at a height of about 10 feet above the pattern, while others riddle the sand in the ordinary manner and depend on skilful ramming to secure the desired density on the face. Around the edges of the pattern the sand is rammed with the rammer, while the sand over the pattern is *tramped off*. The flask must be rolled over carefully to prevent the sand and pattern from sliding.

"After the pattern is drawn the face of the mold is sprayed with thin molasses water or with a thin solution of any water soluble binder. The mold then is baked in the oven or skin dried with a torch or charcoal fire. The usual mixture for tablets is: Copper 90 per cent, zinc 7 per cent and tin 3 per cent. This mixture may be varied to a considerable extent. The addition of ½-pound lead to 100 pounds of the mixture increases the fluidity and thus to a great extent offsets the danger of cold shuts or streaks."

Properties Extend Gray Iron Uses

(*Concluded from page* 23)

recent applications of gray iron in automobile crank shafts, cam shafts, moving parts in the refrigerator field, etc., seem sufficient proof of success.

Damping capacity is a property highly important to users of gray iron. What is meant by damping is illustrated best by imagining the effect produced by striking a cast iron tuning fork as compared with a similar one of steel. The dull sound, of short duration, illustrates the fact that gray iron is 20 times more efficient than steel in damping vibration and has even greater advantages over the lighter aluminum alloys.

The engineering significance of that property of gray iron may be pointed out from two angles. First, gray iron is better than steel for machine bases and housings because it quickly wipes out vibrations and hence the source of many inaccuracies in precision tools and the like. Second, gray iron is on a competitive footing with many types of products of other methods of manufacture because its high damping capacity prevents vibrating loads from multiplying and reaching dangerous proportions. As the implications of damping capacity become better understood and publicized, profitable markets for gray iron will be opened up.

Select Test Bars

Impact or shock resistance is lower than in materials competitive to cast iron. High tensile and high transverse strength with corresponding good deflections imply superior impact properties as compared with irons of lower physical properties. Here again gray iron should be tested in bars which are representative of the working sections of the casting to give most reliable information.

Where users are interested in impact properties founders should be able to suggest tests which are most reliable. The A.S.T.M. committee on impact testing of cast iron as reported in the *Proceedings* for 1933, found that the usual Izod and Charpy tests, common for testing steel, were unreliable indices of the impact strength of cast iron. On the other hand the drop test, using a 25 pound falling hammer on a 1.2-inch diameter bar over a 6-inch span, gave reliable results.

Shear strength is one about which inquiry is made from time to time. The founder who has a thorough knowledge of tensile strength might well remember that shear strength runs from 60 per cent of the tensile strength for the lower strength irons to almost equal values for the high test irons. Tensile strength and shear strength of steel is approximately the same.

Hardness control by chills, alloys and steel in the cupola mix are familiar to most foundrymen. Many foundries have access to either brinell or rockwell hardness machines. Where it is necessary to convert rockwell hardness to brinell hardness the following formula will be found to give good results.

$$\text{Brinell} = \frac{7300}{130 - (\text{Rockwell}_{\text{a}}\ \text{hardness})}$$

Reducing brinell hardness to rockwell hardness would be as follows:

$$\text{Rockwell}_{\text{a}} = 130 - \frac{7300}{\text{Brinell hardness}}$$

Wear resistance is a property which often is associated with hardness. The value and limitations of such tests should be weighed carefully before giving definite recommendations to users. First it should be ascertained which of the following types is most desired.

1. White or mottled iron unmachinable.
2. Heat treated gray iron—sometimes machined with difficulty.
3. Gray cast iron—all degrees of machinability.

The first classification is generally the best when considering materials which are to withstand abrasive action from softer materials, such as rolls, wheel treads and some dies. Irons under that classification also are employed to resist the very hard abrasive materials as are encountered in connection with sandblast nozzles, plow points or mixer paddles. Where strength and shock resistance must be combined the use of the various alloy combinations or the skillful regulation of chill in plain cast iron may be adopted.

Heat treated cast iron for strength, hardness and toughness is one of the newest branches of gray iron metallurgy which should not be embarked on lightly. Without a full realization of the effect of cooling strains in intricate sections, the effect of time and temperature on heating and cooling, and the need of a proper basic structure, results are likely to be disappointing. Through proper application of heat treatment, uses for gray iron are being extended.

Wearing properties of gray iron are dependent on proper balance between two structures which lie in opposition to each other. The antigalling properties of the graphite particles promote softness and open grain unless dispersed in a tough matrix of pearlite. Extent to which one should prevail over the other in resisting abrasion in a cylinder bore, a brake drum or a valve seat depend upon metallurgical testing and control linked closely with the engineering experience of the user. Mutual aid through reports from service tests, adequate hardness specifications and the like are essential for entire satisfaction.

The practical limit in most programs for advances in strength or toughness is in machinability. There is probably more controversy between users and producers on that point than any other. In that connection it is well to remember one of the important generalizations in the *Symposium on Cast Iron*, namely, ease of machining is usually inversely proportional to the strength of the casting. If any broad subject may be reduced to nutshell proportions this is a fair example. Founders never should fail to call users' attention to that point with the further modification that the use of nickel, molybdenum, titanium and other alloys will produce further benefits at an increased initial cost.

Need Machinability Test

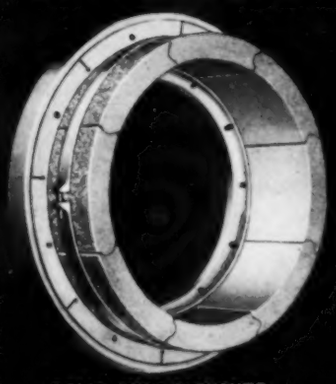
There is no single test yet devised to describe machinability adequately. Therefore it is of utmost importance to a foundryman to learn something of the machining feeds and speeds used on his castings and to make every effort to keep advised of any changes to avoid possible repercussions from customers that may be traced to that source. As the literature on gray cast iron becomes more voluminous from year to year, both user and producer of castings need condensations which will give them information briefly and accurately. The *Symposium on Cast Iron* fulfills that purpose well. In like manner the technical complexities involved in a certain phase of gray iron metallurgy may prevent the minds of buyer and seller from meeting with complete understanding. To enumerate certain broad principles which buyer and seller agree will tap a reliable source of supply, A.S.T.M. specifications have been formed and the foundryman will do well to promote the use and acceptance of gray iron specifications in his merchandising.

Ajax Electrothermic Corp., Trenton, N. J., recently prepared a chart showing the increase of the use of the induction type furnace from its introduction in 1917 to the present time. Total installed capacity on June 1, 1934, was 43,471 kilowatts.

H. P. Clawson, 51 East 42nd street, has been placed in charge of the New York office of the MacLeod Co., Cincinnati.

DO YOU STILL USE THE SOLID WHEEL FOR SURFACE GRINDING?

HAVE YOU SEEN THE STERLING CHUCK AND SEGMENTS?



SOLID TYPE SEGMENTS

GAP TYPE SEGMENTS

You undoubtedly know the many advantages of segmental wheels over solid ring wheels on surface grinding operations, but do you hesitate to investigate this modern grinding unit because of preconceived ideas of its cost.

Would it surprise you to know that an installation of a Sterling Chuck can be paid for out of the savings between the cost of segmental wheels and ring wheels in but a very short time.

Sterling interlocking or gap type segments have long been recognized as indispensable tools by leading concerns whose alertness quickly leads them to the most efficient and economical means of production. It will be a pleasure to show you how real savings can be made in the use of the Sterling Chuck and Segments on these machines.

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Abrasive Division of The Cleveland Quarries Co.

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Sand Control Pays Well

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Moisture Test in	15 seconds
Permeability Test in	12 seconds
Strength Test in	15 seconds

Give your metal a chance to produce Better Castings by Sand Control.

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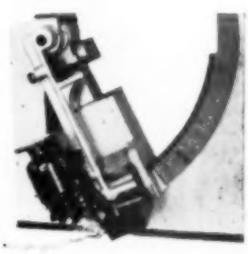
Moisture Indicator

Permeability



Universal Sand Strength Machine Type C. P.

Anneals Malleable in Small Unit

(*Concluded from page* 21)

ditions the malleable foundryman was forced to throw precedent out the window and start annealing in smaller batches. The obvious answer was to run the big ovens one-half or one-third full. This was in many cases very costly from the standpoint of fuel because of the tremendous absorption of heat units by the refractories.

These conditions brought about the advent of the small oven, designed to anneal 5 to 10 tons of castings economically and rapidly. Probably when many started to build the first small oven, it was done with a sigh of resignation, anticipating that something was being adopted which would increase the cost of production with no chance of getting it back in selling price.

Anneal Small Quantities

Actually, after nearly 2 years of experience with two 10-ton ovens, the author is convinced that annealing can be done in such quantities just as economically as in the old style ovens, with nearly a 50 per cent saving in time, with greatly increased flexibility of operating the annealing department and with immeasurably improved service to the customer.

Contrary to many opinions, particularly on the part of the users of malleable castings, this is not due to any radical changes in metallurgical theories or to any mysterious developments in metal mixtures. The developments are rather the result of a realization and study of methods of eliminating the mechanical inefficiencies of the old style ovens.

Development of a satisfactory refractory insulating brick at a fairly reasonable cost called attention to the great number of heat units which were being absorbed by the fireclay brick and the possibility of eliminating this waste.

This development, coincidental with the demand for small batch annealing, resulted in the design of a 10-ton oven to hold 12 stacks of pots. The walls were built of 9-inch refractory insulating brick backed up by 3½ inches of secondary insulation. The crown was 9-inch firebrick covered with 4 inches of secondary insulation. Generous space between stacks and from top of stacks to crown was allowed to permit free circulation and uniform heating.

Provision was made for the subsequent installation of a car bottom to permit emptying and refilling of the oven at temperatures much higher than is possible when unloading by lift truck, but this has not been installed as yet. The fuel is oil. An average cycle in use today is as follows:

	Hours
Time to reach soaking temperature 1650 degrees Fahr.....	24
Held at soaking temperature 1650-1700 degrees Fahr.	24
Cooling to 1300-1350 degrees Fahr.	18
Held at 1300-1350 degrees Fahr.	12
Cooling to handling temperature	18
Total	96

Packing material is used in all pots. Evidence of under annealing is extremely rare. Fuel oil consumption averages the same per ton of castings annealed as in the old style 25 ton ovens. Further savings in time and fuel are available upon the installation of the car bottom. Still further reductions are possible with castings which lend themselves to annealing without packing material.

It is the author's opinion that the future will see the gradual elimination of the large size annealing ovens in favor of more and smaller units wherein the annealing will be conducted with somewhat the same precision as case hardening or other well controlled heat treating operations.

Book Review

The Metallurgy of Iron and Steel, by Bradley Stoughton, cloth, 559 pages 5¾ x 9 inches, published by the McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

The fourth edition of this work, published first in 1908, consists almost entirely of new manuscript. This has been done to bring all of the material up to date, and at the same time provide a rearrangement of the text matter. One of the objects of the rearrangement has been to present the subject largely from the historical standpoint.

The work opens with a general introduction to the early history of the iron and steel industry, including a discussion of later developments in ore smelting, and reference to the first application of chemical theory in ferrous metallurgy. Under the heading of "The Age of Steel," the author gives a summary of iron and steel manufacture. Melting processes and practices are introduced and discussed under "Iron Ore Smelting in the Twentieth Century"; "Modern Open Hearth Practice"; "The Bessemer Process," and "Electric Processes for Producing High Temperatures."

Various phases of the manufacture of iron and steel products then are discussed. The rolling mill is treated under the heading of "The Ingot Making Stage of Manufacture," and forging, pressed metal, wire drawing and other mechanical methods of fabrication are discussed in "Mechanical Treatment of Steel." A substantial portion of the latter part of the book is devoted to the casting of metals and other problems of interest to the foundry industry. Chapters on that subject include "Iron and Steel Founding"; "The Iron Carbon Equilibrium Diagram"; "The Constitution of Cast Iron"; "Malleable Cast Iron"; and "Alloy Steels and Alloy Cast Irons." Information also is presented on the heat treatment of steel.

The book has been prepared to serve as a text book for engineering students, and for workers in industry desiring the information covered.

Gives Alternative Molding Methods

(*Concluded from page* 25)

When this was dried the cover plate with suspended core were returned to place over and in the drag mold. The only chaplets required in this mold were one over each core division near the inner end. Binder bolts around the outside edge of the mold prevented the cover plate from rising when the mold was filled with iron and also held down the inner ends of the cores through the chaplets. Weights on top of the ring W prevented the outer part of the core from rising.

Approves Budget For Gray Iron Industry

National Recovery Administrator Hugh S. Johnson, through Acting Division Administrator Barton W. Murray on June 26 approved a budget and schedule of contributions for the support of code administration for the gray iron foundry industry and also approved an exception for the code authority from certain provisions of executive order X-36.

The budget covering the period from Feb. 10 to Dec. 31, 1934, totals $107,923.40. Members of the industry will be required to contribute on a basis of 50 cents per every $1000 of gross sales per quarter. The exception to executive order permits the code authority to collect assessments from certain members of the industry whose chief products are not manufactured under this code.

B. K. Paget has been placed in charge of the ventilator field of the Swartout Co., Cleveland. Mr. Paget formerly was connected with John L. Nesbitt Inc. and the L. J. Wing Mfg. Co., New York.

ADVERTISING PAGES REMOVED

I. B. F. Discusses Brass Castings

(*Concluded from page 22*)

presidential address followed. After emphasizing the fact that a foundryman's work is essentially creative, the president referred to the developments that have taken place in the technique of the foundry industry in recent years, and pointed out that the Institute of British Foundrymen has taken an honorable part in these developments. He also stated: "This institute was born because it was realized that it is much better that men in an industry should help each other rather than fight each other."

Comparing castings with welded and rolled products, he emphasized that "the foundry product of today has been brought to a very high quality from the standpoint of operating performance and safety." Dealing with the question of mechanization, the president refuted the statements often made, to the effect that mechanization results in a loss of craftmanship and in lowering the quality of workmanship. He then discussed recruitment problems of the industry, and emphasized the fact that under modern industrial conditions there is need for a training unknown in former times. He also stressed the necessity for bringing a larger number of young men into the industry.

In his concluding remarks, the president said: "It is a wonderful thing to be connected with an industry which is so old that we cannot find where it began, and yet which is so young, so inexperienced, so unknown that it challenges the best of our executive ability, the best of our engineering skill, the best of our scientific research."

Establish Foundry Degree

After the conclusion of his speech, the president made the formal announcement that a degree in founding had been established at the University of Sheffield, under the chairmanship of Prof. J. H. Andrew, that the courses will begin with the next term, and that students will thus be able to qualify for the degree of bachelor of metallurgy, B. Met. (Founding).

The first technical paper was a report of the work of the cast iron subcommittee of the technical committee, entitled: "Total Carbon and Phosphorus in Relation to the Porosity and Strength of Cast Iron—Contraction—Carbon Pick Up—Microstructures—Wear Testing." The report was presented by P. A. Russell.

Referring to the test bars used by the subcommittee, Prof. Champion stated that he was in favor of adopting the specifications proposed. The larger bar, of 2.2 inches, used by the subcommittee was described as causing the edges of the testing machine to dig into the bar, but this could be remedied easily. He urged that further investigations be made with regard to phosphorus and stated that, while total carbon is an important factor, more account should be taken of the condition of the carbon and the manner in which it is distributed.

Referring to the reference to a dangerous range of phosphorus content, around 0.5 per cent, he said he was doubtful about the existence of this range. He also pointed out that porosity is due, to some extent, to the fact that iron has a freezing range and not a freezing point, which causes certain intercrystalline conditions conducive to porosity. He did not agree that the pouring temperature can be an important factor of porosity, but said that the initial temperature of superheated metal and the period of superheat were more important factors. He pointed out that in the rotary furnace, iron can be melted with a carbon content approaching 2 per cent.

Phosphorus Over Rated

J. G. Pearce said that there has never been real theoretical reasons to support the idea of a dangerous range of phosphorus. There have been numerous examples of good castings being obtained with quite a medium phosphorus content, but the carbon content must be below the eutectic value. In low-silicon irons, the phosphorus can be increased without danger of porosity. Certain rules or formulas, such as silicon plus phosphorus should not exceed 2.5 per cent, can be useful.

Referring to the test bar, he said that he also had observed the difficulty concerning the knives digging into the larger bar, but he had found that the amount of error thus introduced was practically negligible.

John Shaw pointed out that in Great Britain there is a predominance of high-phosphorus iron. Therefore, the subcommittee might investigate how medium phosphorus irons can be used for making sound castings. He said that carbon content easily can be brought down to 3 per cent in the cupola. Referring to the test bars, he stated that there should be an intermediary bar between the one of 1.2 inches and the one of 2.2 inches.

F. J. Cook, referring to a mention made in the report to a past work of which he was the author, said that he had never been dogmatic about the phosphorus danger zone, but he has seen many cases tending to confirm its existence. Bolton, in America, has shown that there is a distinct change in the iron when the phosphorus content passes the 0.5 per cent point. He thought, however, that what matters mostly is the total carbon. If the total carbon is even just below the eutectic point, phosphorus is not detrimental. He had proof of this in making diesel engine pistons with as much as 1.4 per cent phosphorus, without any breakdown.

The exchange paper of the Verein Deutscher Eisengiessereien, of Germany, was presented by its author, Dr. Ing. Heinrich Nipper, of the Technical High School of Aachen, who gave a message of greeting on behalf of the German association. The title of the paper was "Contribution to the Study of Graphite Formation and Structure in Cast Iron and Its Influence Upon the Properties of the Cast Metal."

A. Harley pointed out that one of the microstructures given in the paper showed a sample with small graphite flakes which was said to have less resistance to corrosion than when the flakes are larger. This would be of great importance in automobile work, where wear is often a matter of corrosion, because for several reasons small graphite flakes should be obtained, but if they lessen resistance to corrosion, there is a problem to solve. Dr. Nipper confirmed this point, and added that the aim should be to obtain the graphite in such a condition that the aggregate surface of the graphite should be small in relation to its actual quantity.

J. G. Pearce said that we now know that strength in cast iron is not due altogether to its composition, but it is also a question of structure. Referring to supercooling effects mentioned in the paper, he said that when an iron is superheated, the tendency to supercool increases. This supercooling action, under certain circumstances, gives the fine graphite flakes shown in the microstructures. This extremely fine graphite is generally an unfavorable factor. He pointed out that inoculation originated with the desire to remedy these effects of supercooling.

Present American Paper

Two separate sessions were held on the morning of June 6. The American exchange paper was the first to be presented in the nonferrous section, which was presided over by J. E. Hurst, senior vice-president. The author of the paper was C. M. Saeger, Jr., physicist, U. S. buearu of standards, Washington, the title being: "Studies on Cast Red Brass for the Establishment of a Basic Classification of Non-Ferrous Ingot Metals for Specification Purposes." The paper was presented in abstract by Vincent Delport, and has been presented in the June and July issues of THE FOUNDRY. This paper created considerable interest and was the subject of a full discussion, in which several members of the subcommittee on nonferrous castings of the Institute of British Foundrymen took part.

J. S. Primrose, convener of the

British subcommittee, started the discussion by saying that their subcommittee were pursuing investigations on the same lines as those indicated in the paper, only under conditions more closely resembling actual foundry practice. He pointed out that in the American test bar there remains certain internal stresses of the metal. The British have two sizes of test bars and are able to show figures for mechanical properties that are quite high. He also said that they are trying to bring down about 200 specifications to five. They are also endeavoring to arrive at a comparison of conditions between dry sand and green sand molds.

F. W. Rowe, a member of the British subcommittee, recommended that a test bar be chosen that could be standardized easily and that would give good average figures for all foundries. He mentioned that the British investigators had found that the fin-gate sand-cast bar does not give good results in all conditions. He also suggested that green sand molds do not give uniform good conditions, but that dry sand molds would do so.

Sulphur Is Deleterious

Referring to the effects of sulphur, he stated that the paper seems to show that sulphur up to 0.10 per cent was not of great importance if a certain casting temperature is arrived at; he pointed out that the method of adding sulphur used by the author of the paper differed from the conditions under which sulphur occurs in foundry operations, and that in the latter case sulphur is deleterious. He also pointed out that the range of temperatures considered could be extended below the minimum, in a region where trouble generally occurs. He concluded by saying that the further continuance of this work will be of great value in the future to the foundry industry at large.

V. C. Faulkner suggested that the foundry proprietor or manager is likely to take more interest in an alloy that is sold under a trade mark than in one designated under a specification. A. Logan, a member of the British subcommittee, said that a large number of customers specify a considerable variety of compositions that considerably complicate foundry operations. The work of the subcommittee, and of investigations such as those described in the paper, will simplify considerably nonferrous foundry practice. Referring to the conclusions of the author of the paper on running properties, he said it was remarkable that thase properties should be greater for remelted than for virgin metal. He agreed with the author that casting temperatures is of paramount importance, but he also agreed wtih Mr. Rowe's remarks concerning the effects of sulphur on the metal properties.

Dr. J. W. Donaldson also emphasized the necessity of standardizing compositions. He said that test pieces, also casting temperatures, should be standardized for the purpose of such tests as described. He also confirmed Mr. Rowe's remarks concerning sulphur effects. A. Harley, past-president, said that the whole of the copper alloys used in the automobile industry, in which he is concerned, is reduced to six compositions. He stressed importance of melting problems.

During the discussion, J. S. Primrose mentioned that the British subcommittee will recommend ranges of alloys of similar compositions, with slightly variable mechanical properties within these ranges. This procedure tends to standardize a small number of ranges of composition, but with a certain amount of elasticity. The British committee has also submitted a survey of the various types of furnaces that can be used. Mr. Logan, who is interested in the shipbuilding industry, and W. Dunkerley, of the London & North-Eastern Railway Co. each said that in their respective industries six compositions only were used, but not necessarily the same for each; the ultimate goal would be to arrive at national standardization.

The next paper was: "Studies in Cast Bronzes," by F. W. Rowe, head of the foundry laboratories of David Brown & Sons (Huddersfield), Ltd. The author dealt specially with the physical properties obtaining with cast bronzes of various composition and under varying casting temperatures and varying mass.

Tin Preferable As Hardener

Replying to a remark by V. C. Faulkner on the hardness of the alpha-delta eutectoid, Mr. Rowe stated that the high figures obtained for hardness in certain bronze constituents make the real value of these alloys. A. Harley having pointed out certain differences in results of tests between a bronze with 10.5 per cent tin on the one hand, and a bronze with 10 per cent tin and 1 per cent phosphorus on the other, Mr. Rowe said that, as a hardener, tin is preferable to phosphorus, for the higher the phosphorus the more brittle is the alloy; phosphorus alloys definitely have a lower density.

A. Logan stressed two main conclusions brought out in the paper: first, that the effect of increasing phosphorus contents is to increase the chances of unsoundness and porosity in castings; secondly, that the mass effect is not of so great importance as the casting temperature. This second conclusion was confirmed in the American exchange paper, and also by Mr. Logan's own investigations. Unfortunately, many foundries still operate without proper checking and control of casting temperature. Mr. Rowe, in reply, emphasized that in his paper the mass effect should not be taken as a criterion, owing to the special conditions of the test.

During the session that was run concurrently with the nonferrous session, the following papers were presented: "Oven-Drying of Cores and Molds," by E. G. Fiegehen, of Longueil, Quebec, Canada; "Recent Developments in British Synthetic Molding," by John J. Sheehan, Austin Motor Co., Ltd., Birmingham; and the French exchange paper: "On the Use of High-Duty Cast Iron in the Manufacture of Textile Machinery," by A. Roeder, chief chemist, Societe Alsacienne de Constructions Mecaniques, Mulhouse.

Metallurgist Joins Staff of Climax Company

Victor Crosby, formerly metallurgist for the foundry of the Studebaker Corp., South Bend, has become connected with the metallurgical staff of Climax Molybdenum Co., 295 Madison avenue, New York. Mr. Crosby will be connected with the Detroit office of the Climax firm.

Victor Crosby

Mr. Crosby was graduated from the University of Mississippi in 1916. Shortly after finishing his technical training, he served for 16 months as a lieutenant in the U. S. army air service. Following the war, he served successively as chemist with Dodge Bros., chemist with the Portland Cement Co., chief chemist with the Briscoe Motor Co., and assistant chief chemist, foundry metallurgist and finally chief metallurgist with the Packard Motor Car Co. He became connected with the Studebaker Corp. in 1921.

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Franklin twisted steel gaggers overcome "drop-outs" and on account of their distinctive twist are readily recognized and separated from scrap.

The spiral twist permits the use of much smaller gaggers and at the same time provides more than four times the grip on the sand when compared with a larger size deformed bar gagger.

We are also manufacturers of twisted tempered steel tumbling barrel stars.

Pioneers since 1910 in gagger making.

For sale by all foundry supply houses.

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Twisted Steel GAGGERS

Four times more grip than other gaggers! Sizes: 1/4"-5/16"-3/8"-1/2"-5/8"

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Tempered Twisted STARS

Eight points!—Twelve cleaning edges!—Long life! Sizes: 3/4"-1"-1 1/2"-2"-2 1/2"

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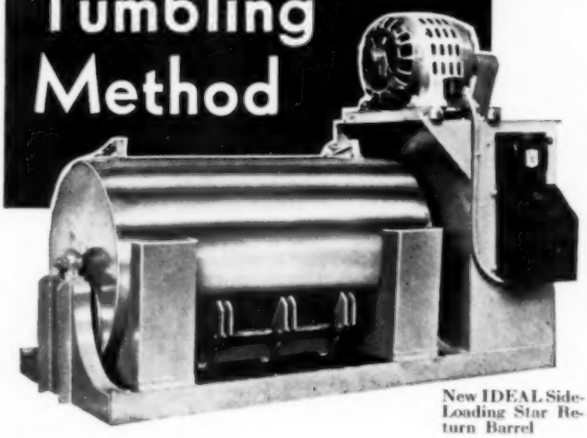

New IDEAL Side-Loading Star Return Barrel

Reason No. 3

Because the stars never leave the machine a greater weight of stars, and *smaller* stars, can be used. This means 10 or 12 times as many cutting points as are available in the average barrel.

Result—better and faster cleaning, especially of concave surfaces.

If you want at once the five other reasons why this system cuts tumbling costs, improves finish, write us.

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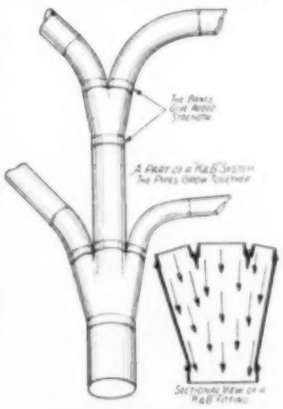

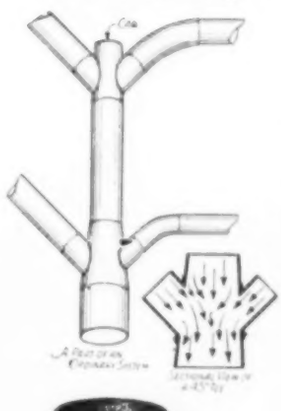

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One-piece, machine made elbows: perfectly round, smooth inside, unusually strong. An exclusive K & B product.

The method of joining branch pipes to the main lines effects the efficiency and economy of power used. The sectional drawings (above) comparing the ordinary type of fitting with the K & B direct-current fitting, make clear the difference between the flow of air in the two types. The velocity of air in the piping is from 3,000 to 5,000 lineal feet, or nearly a mile per minute.

The incoming air from the branch pipes of the ordinary 45 degree tee, striking the air current in the main pipe at an angle of 45 degrees, causes whirls and eddies, retards the flow of air and creates friction. Therefore, in the ordinary tee extra pressure is required to overcome this friction, extra pressure calls for a higher fan speed and higher fan speed means wasted power.

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European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Contraction of Iron

Study of Contraction. (Etude du Retrait) by the Scientific Committee of the Belgian foundry technical association. Rapporteur: Rene Berger. *La Fonderie Belge.* Liege, January-February, 1934.

On the average, solid contraction is about 1 per cent for gray iron and 2 per cent for white iron. The article reviews the work that has been done by a number of authors on the subject of solid contraction, and gives the following conclusions:

Solid contraction comes under four phases:

(a) The phase of primary graphitization, occurring immediately after solidification in gray irons and accompanied by an increase of volume;

(b) Pre-perlitic contraction, between 1150 and 720 degrees Cent., for a given carbon content and a given cooling rate decreases with the silicon content and increases with manganese and sulphur. For a given iron, it is function of the cooling rate.

(c) Perlitic transformation phase, at about 720 degrees Cent., accompanied by an increase of volume.

(d) Post-perlitic contraction, between 720 degrees Cent. and ordinary temperature which is practically constant for all irons and is about 1 to 1.1 per cent.

A chart prepared by Marcel Remy is given, which shows the variations of contraction in the different states of the metal: liquid, during the period of solidification, and in the solid state.

As a general conclusion of the investigations carried out by the Belgian scientific committee, it is stated that while it is possible to know approximately the general behavior of the contraction of cast iron, independently of the iron's mode of crystallization, it has not yet been possible to distinguish between the influences of the various elements: Silicon manganese phosphorus, sulphur and carbon.

With regard to future studies, emphasis is laid on the necessity of adopting a precise method of measurement; and for the time being the method recommended by the bureau of standards is suggested.

Solidification

Importance of the Process of Eutectic Solidification on the Properties of Cast Iron. (L'Importance des Processus de Solidification Eutectique sur les Proprieties de la Fonte, by Prof. E. Piwowarsky. *Bulletin* de 'Association Technique de Fonderie, Paris, March, 1934.

For a given chemical composition, each type of metallurgical treatment which is capable of affecting the matrix of a cast iron, and, therefore, the properties of the iron, acts by a displacement of the eutectic points of the solidification curve. It appears, therefore, that the observation of the true temperatures of eutectic solidification by thermic analysis, and the observation of any surfusions that may occur, are an ideal means of forecasting influence of certain methods of treatment or of industrial processes on the structure, and, therefore, on the properties of cast iron.

The author describes examples bearing on displacement of eutectic temperatures in iron-carbon alloys. He shows the influence of superheating the bath; of decreasing the carbon content; of a last-minute addition of silicon; of certain elements such as nickel, manganese, molybdenum; the breaking-up in two of eutectic points during cooling; the practical application of the superheating of gray iron; and the influence of gases and of the constitution of slag.

The second part of the article discusses rate of dissolution of graphite in liquid iron. Following a certain number of tests, it would appear that existence of a certain amount of nondissolved graphite in iron is not the principal cause of the influence observed of an increasing superheating of the iron. The trend of present research shows certain directions in which new improvements can be looked for in the characteristics of cast iron.

Pouring Bronze

Copper Alloys—Influence of Melting Losses on Costs—General Considerations on the Melting and Casting of Bronze in Green Sand (Les Alliages Cuivreux—Influence de la Perte au Feu sur les Prix de Revient—Considerations Generales sur la Fusion et le Moulage du Bronze a Vert), by A. Brizon. *Bulletin* of the Association Technique de Fonderie, Paris, January, 1934.

Melting losses have considerable influence on metal costs in a nonferrous foundry. The difference between actual weight of metal poured from the furnace and weight of metal charged into the furnace, related to a charge of 100 kilos, is termed "melting loss factor."

This factor is influenced by the chemical composition of the alloy, the quality, or grade, of the raw materials used, the pouring temperature, the control of the furnace, and the nature of the furnace.

For the producer of castings, it is of interest to know by how much the price of the metal entering into 100 kilos of good castings should be multiplied, so that the value of melting losses should be recovered.

Dealing with the subject of casting bronze in green sand, the author claims that, providing certain esential precautions are taken, such castings can be obtained readily and give many advantages such as saving of space and labor, speedy output, quality of castings, and the possibility of employing production methods.

After stating that during 10 years' experience he has obtained consistenly good results, the author explains in detail the precautions to be taken to secure such results. In his conclusions he states, with reference to bronze castings: (1) Pouring should be effected on the ascending range of temperatures; (2) For a given casting, pouring should be effected at as low a temperature as possible; (3) This pouring temperature should be reached as quickly as possible.

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TOUGHNESS
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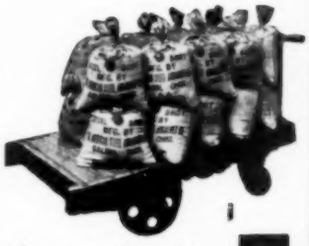
American «Eversharp» Steel Grit and «Standardized» Steel Shot have no equal.



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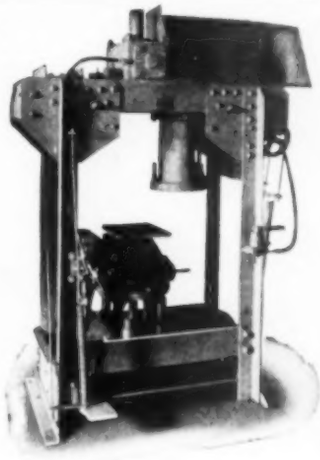

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Kewanee, Illinois

Obituary

DAVID HALLIDAY for over 50 years connected with the foundry industry, died recently. Mr. Halliday was born in North Andover, Mass., in 1859. He learned the foundry business with the Davis & Furber Co., North Andover, and worked for a time with New England concerns. Later he was connected with the Worthington Pump Co., Elizabeth, N. J., the Struthers-Wells Co., Warren, Pa., and in 1919 he went to Cudahy, Wis., where he built a foundry for the International Gas Engine Co. In 1912 he took charge of the foundry of the Fairbanks Morse Co., Torronto, and in 1916 became cost expert of that company with headquarters in New York. He retired in 1921. In 1926 he was requested by the Pomona Pump Co., Pomona, Calif., to organize its foundry for machine molding. He retired again in 1931 because of poor health and for the past 2 years has made his home at Manhattan Beach, Calif.

• • •

R. A. Heesen, 69, president, Heesen Bros. & Foundry Co., Tecumseh, Mich., died recently.

• • •

W. M. MacKenney, 62, president, Butler Engine & Foundry Co., Butler, Pa., died at Butler, June 4.

• • •

Fred Knadler, 67, who retired 10 years ago as general adviser to the National Malleable & Steel Castings Co., Cleveland, died in Cleveland, June 19. He had been with the company 43 years when he retired.

• • •

Joseph Foertsch, 69, one of the organizers of the Cream City Foundry Co., and its president until his retirement in 1922, died recently at his home in Milwaukee. Mr. Foertsch was born and reared in Milwaukee.

• • •

Frank O. Green, 73, former president of Green Foundry & Furnace Works, Des Moines, Iowa, died in that city, June 23. He was active head of the company for 26 years, retiring from active management in 1930.

• • •

John T. Dillon, 74, formerly president, Struthers-Wells-Titusville Corp., Titusville, Pa., died in New York recently. Mr. Dillon was born in Olean, N. Y. and spent his boyhood in that city and in Indianapolis. In 1897 he founded the Titusville Forge Works, which was sold to the Bethlehem Steel Co. in 1916. Shortly after he purchased a controlling interest in the Delaney Forge Works, Buffalo, and later he was interested in the Canadian Forge Co., Welland, Ont. In March, 1919 Mr. Dillon headed a group that purchased the Titusville Iron Works and about 5 years ago that company with the Titusville Forge works and the Struthers-Wells Co. of Warren, Pa., were merged into the Struthers-Wells-Titusville Corp.

• • •

John Randolph Neison, chairman of the board of directors, Ajax Metal Co., Philadelphia, and also treasurer of the company, died recently at his home in Rydal, Pa. Mr. Neison has been connected with that company since March, 1882 and served in various capacities until he finally rose to the highest office. He was also vice president of the Abington Bank & Trust Co., Abington, Pa.

Presents Interesting Display at Chicago Fair

The industrial exhibit of the Link-Belt Co., Chicago, in the general exhibits building of the Century of Progress exposition is exceptionally interesting. The company's mechanical materials handling machinery and positive power transmitting

View of Link-Belt display at the Century of Progress in Chicago

equipment are portrayed in beautiful colored illuminated glass pictures, in working models; in dioramas; and in action machinery units.

The working models include a pivoted bucket conveyor for handling coal, ashes, etc.; a crawler dragline handling dirt; and a rotary railroad car dumper. A view of the exhibit is shown in the accompanying illustration.

German Society Issues Souvenir Book

The Verein Deutscher Giessereifachleute which celebrated its twenty-fifth anniversary at it anual meeting held in Berlin May 25 to 27, published a 156-page book as a souvenir of the occasion. The book is divided into two parts, the first containing information on the formation and operation of the Verein Deutscher Giesesreifachleute with lists of names of its founders, honorary members, chairmen, directors, advisors, etc. In addition biographies of some of the leading members are presented. The second section is devoted to articles by various members on 25 years progress in various phases of the German foundry industry.

British Institute Hears Paper on Cast Iron

The annual meeting of the British Iron & Steel institute was held in London, May 31-June 1. At one session J. G. Pearce, director and secretary of the British Cast Iron Research association, Birmingham, presented a paper on "The Elasticity, Deflection and Resilience of Cast Iron," in which he explains that the deflection in transverse of gray cast and malleable cast iron comprises two components, elastic deflection and plastic deflection or permanent set. The separation of these components shows that the former is usually a straight line directly proportional to the load and differing relatively little from iron to iron, while the latter increases at a much greater rate than the load, and exhibits wide variations in magnitude between different irons.

Book Review

A.S.T.M. Tentative Standards, cloth or paper, 1136 pages 6 x 9 inches, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $7 in paper and $8 in cloth, plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

The 1933 edition of this annual publication contains all tentative standards, methods of test and definitions of terms issued by the A. S. T. M. covering engineering materials and the allied testing field. This book contains 223 tentative standards of which 47 are published for the first time and some 41 were revised in 1933 and are given in their latest approved form. Thirty-four of the items deal with ferrous metals, 21 with nonferrous metals, and several with refractories and similar materials.

New tentative standards for alloy steel and carbon steel castings are published for the first time. New tentative test methods include the impact testing of metallic materials, short time-high temperature tension tests and creep tests. In addition to all of the A. S. T. M. tentative standards, this edition gives proposed revisions to standards, which are published tentatively to elicit criticism before final adoption. Changes have been proposed in 46 standards.

ADVERTISING PAGES REMOVED

New Equipment

For Foundries

Electric Glue Pot Has Thermostatic Control

Russell Electric Co., 364 West Huron street, Chicago, has developed an electric glue pot which is thermostatically controlled. It is claimed that the pot will hold glue temperatures within 1 degree Fahr.

Double asbestos insulation prevents loss of heat

Double asbestos insulation prevents loss of heat through radiation, so that the outside shell of the pot is barely warm. The mica insulated element, according to the manufacturer, will not absorb moisture, and therefore will not ground and cause shocks. The element may be replaced easily. The pots are manufactured for use either with 110 or 220 volts. A cutaway view of the electric pot is shown in the accompanying illustration.

Lens Absorbs Objectionable Light Rays

Lincoln Electric Co., Cleveland, has introduced a protective welding lens which it is claimed will absorb all objectionable rays and at the same time hold visibility at a point which permits a clear view of the work without tiring the eyes. The lens is made in two shades according to the brightness of the arc; light for metallic arc welding and dark for carbon arc and heavy metallic arc work. Standard size of the lens is 2 x 4¼ inches.

Single Operating Valve Controls Rockover

A single cylinder air operated rollover mechanism features the jolt rockover pattern draw molding machine of the Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland. Both rollover and rollback operations are controlled by a single operating valve of new design. The motion of the table in both directions is smooth and steady, coming to rest gently and positively. This movement is adjustable to suit the weight of the job being handled.

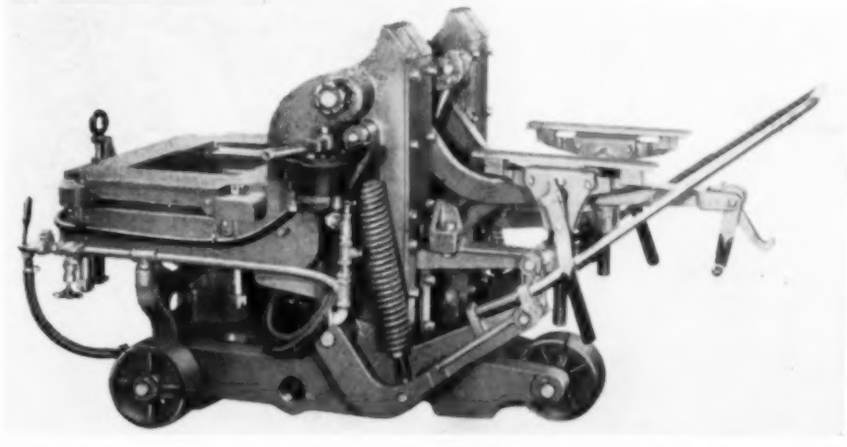
The jolt operation is controlled by the balanced jolt valve which provides for adjustment both as to length of stroke and hardness of blow. A hand operated clamp of the eccentric type holds the flask and bottom board firmly in position during the rollover operation. The table plate is kept in alignment by four guide pins and is locked automatically to the rollover table frame at four points preparatory to rolling over.

The pattern draw operation is performed quickly and easily by hand, the load being counterbalanced by adjustable spring tension. The design includes large V type guides with broad wearing surfaces to give long and accurate service. A levelling device is provided to maintain accuracy of draw regardless of variations in shape or position of bottom board. The machine is mounted on wide faced wheels to facilitate convenient movement about the foundry.

Portable Unit Indicates Hardness

R. Y. Ferner Co., Investment building, Washington, is introducing a portable hardness testing instrument which it is claimed is especially adapted to rapid tests of large castings. The units operate on the principle of a rebounding pendulum. The instrument is held against the piece to be tested and the pendulum hammer then is released by a pin on the rear of the instrument. Upon striking the piece undergoing test, the pendulum hammer rebounds steering the pointer along with it to a point on a scale representing the limit of the rebound, thus giving an indication of the hardness of the material. A light wire is stretched across the pointer and bends it down slightly over the inner edge of the dial, thus holding the pointer at the maximum point of rebound.

The dial is graduated in angular degrees of rebound and the instrument will repeat its readings within half a degree on adjacent spots of the same hardness. If scleroscope,



Smooth, steady operation is provided for the table as it moves in either direction

brinell or rockwell hardness numbers are desired, they can be obtained with a conversion table. The unit also may be used to obtain a comparison of different parts of the casting to discover soft spots.

Press Designed for Straightening Gaggers

Williams, White & Co., Moline, Ill., recently has developed a press which is a rod forming press, straightener, and shear. The equipment is operated hydraulically and will handle stock up to 1-inch in diameter. It is adapted to bending and straightening gaggers, reclaiming bolts and tie rods, for production bending and shearing.

Hydraulic power is supplied by a pumping plant in the rear

The shearing and bending dies are in the upper block, the straightening dies in the lower block, and are made up of a series of V blocks which overlap each other. No change in setup is necessary to perform any of the different operations.

Hydraulic power is supplied by a self-contained pumping plant in the rear of the machine, which has sufficient volume at low pressure for rapid transverse stroke, and small volume at high pressure for the working stroke. The pumps are coupled directly to a 5 horsepower motor. The unit includes release valves for cutting out the low pressure pump at the end of the transverse stroke, and high pressure pump when maximum load is reached. Operation is controlled by a foot treadle.

Charles J. Neyens has been appointed secretary and director of sales of the Eagle Grinding Wheel Co., Chicago. This company recently changed its name to its present title, formerly having been the Eagle Emery & Corundum Wheel Co., which was incorporated in 1892.

Flexible Tooth Gear Used in Blower

Roots-Connersville Blower Corp., Connersville, Ind., has developed a flexible tooth gear, which is used on the larger sizes of its line of blowers and gas pumps. These gears, having epicycloidal addendums, with radial flanks, are designed to have at least three teeth in working contact at all times. The individual tooth is designed to flex a fraction of a thousandth of an inch at the time when it comes into initial contact with its mating tooth, and is said to allow the pressure to be distributed among the three pairs of teeth which theoretically are under load. The feature claimed for this design is that it results in the maintenance of a better oil film and practically eliminates shock forces and acceleration forces.

The gears shown in the accompanying illustration are 36-inch pitch diameter, 16-inch face, and designed to transmit 1000 boiler horsepower at a speed of 360 revolutions per minute, or a pitch line velocity of about 3400 feet per minute. The cast iron mixture used in the gears contains 40 per cent steel, 1 per cent chromium and 2 per cent nickel. The metal shows a tensile strength of 42,100 pounds per square inch with a standard arbitration bar.

To Handle Sales

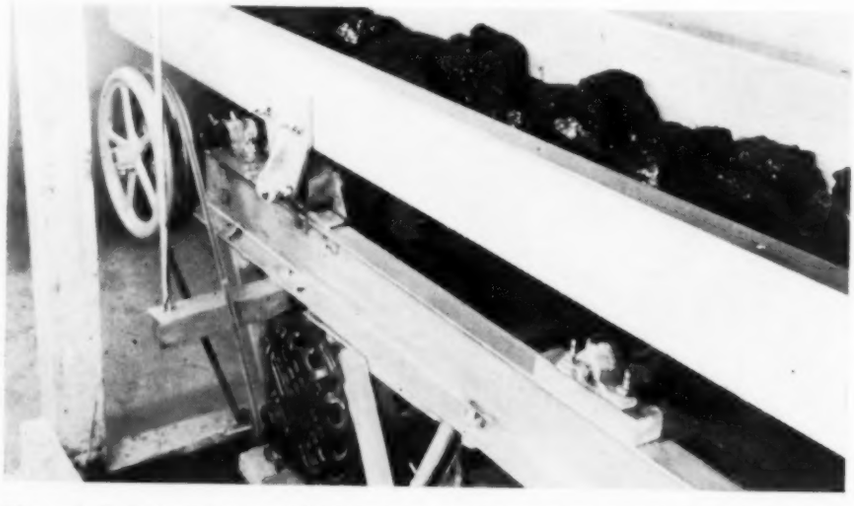
George C. Bowers has been appointed sales representative of the Jeffrey Mfg. Co., Columbus, O., for its line of material handling equipment in Minnesota, North Dakota and South Dakota. The branch office will be located at 311—Third avenue, South Minneapolis, Minn. Mr. Bowers has had more than 15 years experience in the field of handling equipment.

The design provides three teeth in working contact at all times

Conveyor Operates On Lift Throw Principle

Progressor Conveyor, 205 West Wacker drive, Chicago, is introducing a conveyor-screen for handling sand, coal and other materials either horizontally or up an incline. The conveyor operates on a lift-throw principle, the path of motion being an arc slightly less than 90 degrees between the horizontal and vertical centerlines of the arc. The total movement is less than ½-inch.

The trough is mounted on parallel shafts having eccentric pin extensions. These shafts oscillate through connecting rods operated by a revolving crank shaft which is motor-driven, the oscillations imparting a positive conveying motion up to 40 feet per minute. Furnished in various sizes, an 18-inch conveyor is designed to handle as much as 100 tons of sand per hour. It is claimed a vigorous screening action is produced by increasing the speed of oscillation, making it possible to screen and convey material by the same unit having several screen decks or a series of screens in a single deck. Troughs are available in either the open or dust-tight type.



The unit is designed to provide vigorous screening when operated at high speeds

Melting Iron in the Cupola

by

J. E. Hurst

CHAPTERS

1—Historical
2—Construction
3—Operation
4—Charging
5—Receivers
6—Combustion
7—Tuyeres
8—Specials
9—Blowers
10—Linings
11—Briquets

Cross Index Listing over 1,000 Items, 240 Pages, 6″ x 9″—126 Illustrations

THIS book covers practically every phase of cupola construction, operation, etc. It is written and illustrated in a manner that will appeal to every foundryman whose work from any angle brings him into contact with the oldest, most convenient and most economical device known for melting iron in the foundry.

The author is recognized as one of the world's foremost authorities on melting by the cupola method. He is a well-known British foundry metallurgist, author of "Metallurgy of Cast Iron" and many papers on individual phases of the same subject. In this, his latest book, Mr. Hurst gives you the net result of his many years of research and practical experience.

Each subject is treated in a thoroughly informative manner to the extent of approximately 20 pages. Original work on the part of the author has been supplemented by an exhaustive investigation of the work carried on by other practical and scientific foundrymen in this field.

Their theories and findings have been incorporated in the text. The book will meet the requirements of the novice who is making his first acquaintance with the foundry cupola. It will serve as a text book for those who desire to teach cupola melting theory and practice to others. To those who already are familiar with the subject, the book will prove an invaluable reference with its wealth of illustrations, tables, formulas and other statistical data.

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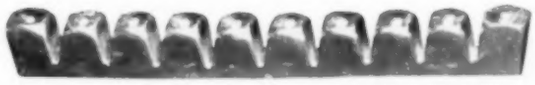

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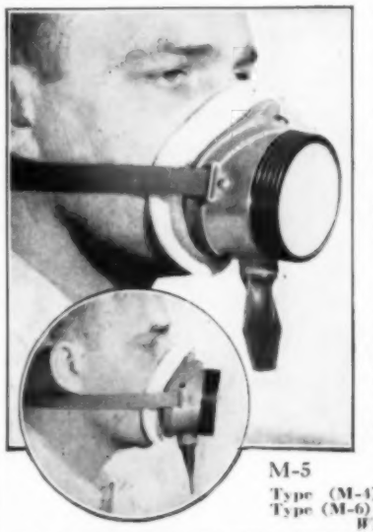
IMPROVED RESPIRATORS

The new "M" Series Improved Pulmosan Dust Respirators are designed to meet the need for a heavy duty respirator to combat severe industrial dust conditions.



- Filter 3" diam.
- Larger Wire Mesh
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- Positive Exhaust Valve
- All Rubber Headbands
- Goggles Easily Worn
- Designed by Dust Control Engineers

The Type "M-5" (illustrated) embodies the above new features. Lower breathing resistance due to direct air flow to the face. The body is one piece aluminum shell, threaded at outer rim so filter cap can be readily attached.

M-5
Type (M-4) without exhaust valve
Type (M-6) exhaust and intake valve
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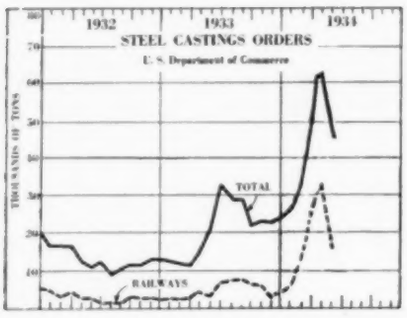
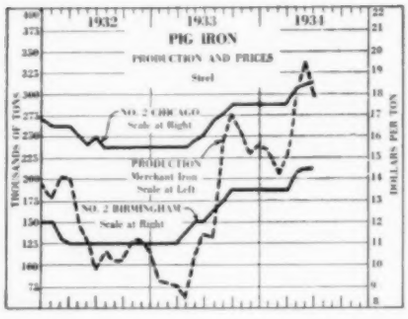
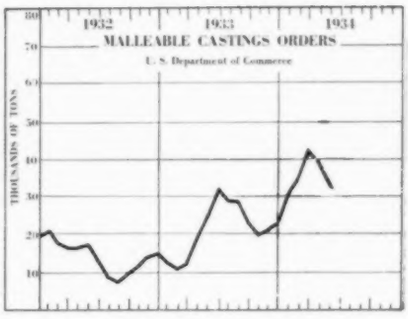






Foundry Activities

Reflect Industrial Trends

WILLIAMSTOWN FOUNDRY CORP., Williamstown, N. J., is the name under which the new owners have reorganized the old Williamstown Foundry Co., Williamstown, N. J. The officers are: President, Walter A. Schaufler, vice president, treasurer and general manager, Phillip E. Wright, secretary Joseph de V. Keefe. The plant is in operation and is engaged in the production of soil pipe, fittings and plumber's castings.

* * *

Production of steel castings in the Philadelphia federal reserve district increased in May for the sixth consecutive month, according to reports received by the Industrial Research department of the University of Pennsylvania. Production of gray iron castings increased 2 per cent over the previous month and the output of malleable iron castings declined 2 per cent in the same period.

* * *

John E. Benson, 1183 East Nineteenth street, Portland, Oreg., has leased a plant formerly occupied by the Harrison Foundry & Machine Co., 525 North Twenty-eighth street, and has opened for business under the name of the American Iron Works. The company makes alloy iron castings and brake shoes.

* * *

Sibley Machine Co., South Bend, Ind., and the Motor Castings Co., South Bend, recently was consolidated into the Sibley Machine and Foundry Corp., with plant at 206 East Tutt street.

* * *

United States Pipe & Foundry Co., Burlington, N. J., is equipping its No. 3 shop for the manufacture of cast iron roof plates. Some of the equipment is coming from its Scottdale, Pa., plant.

* * *

J. W. Pohlmann Foundry Co., 205 Baitz avenue, Buffalo, has changed its name to the Pohlman Foundry Co. Inc. No change has been made in the organization.

* * *

Gasket Mfg. Co., has purchased the plant of the Peninsular Stove Co., Brightmoor, Mich., a suburb of Detroit, and will move its factory to the new site.

* * *

Machine shop and office building of the Norwalk Foundry Co., Norwalk, O., recently damaged by fire, will be rebuilt according to A. B. Hamilton, president.

* * *

International Harvester Co., Chicago, has installed direct arc type furnace at its plant at Cicero, Ill., for the production of gray iron and steel castings.

* * *

Imperial Die Casting Co., 4707 West North avenue, Chicago, has been incorporated by Phillip H. Schoefield, John Paulding Brown and M. Ogden West.

* * *

Atlas Foundry Co., Charlotte, N. C., has been formed with capital of $10,000 by E. Frohman, 1361 East Morehead, and L. J. Nolen.

* * *

Modern Pattern Works Inc., Detroit, has been formed to conduct a pattern-making business by J. Albert Schaldenbrand, 2934 Cadillac avenue.

* * *

Central Casting Inc., Allentown, Pa., has been organized by Leo & Joseph Zellinger. The company is located at 102 South Third street.

* * *

U. S. navy yard, Washington, has installed a 300 kilowatt high frequency type melting furnace for the production of alloy steel castings.

* * *

Index of orders for foundry equipment in May were 66.5 compared with 67.8 in April and 25.6 in May, 1933.

* * *

N. & S. Foundry Co., 1140 Elliott avenue West, Seattle, is enlarging its plant and constructing a pattern shop.

* * *

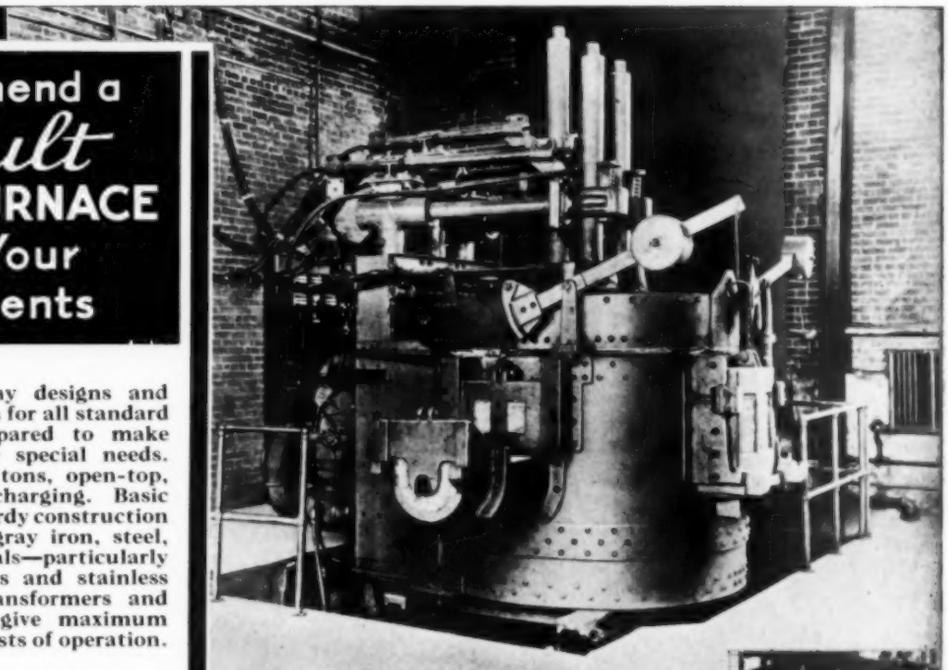
Traction Foundry Co., Laporte, Ind., idle for several years, recently was reopened for business.

RAW MATERIAL PRICES
July 5, 1934

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.10
Wise county beehive coke	3.50 to 4.25
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$11.50 to $12.00
Heavy melting steel, Pitts.	11.75 to 12.25
Heavy melting steel, Chicago	9.50 to 10.00
Stove plate, Buffalo	8.50 to 9.00
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	8.50 to 9.00
No. 1 cast, Pittsburgh	13.00to 13.50
No. 1 cast, Philadelphia	12.00
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	11.25 to 11.75
Car wheels, iron, Chicago	10.00 to 10.50
Railroad malleable, Chicago	10.00 to 10.50
Malleable, Buffalo	12.00 to 12.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.75
Straits tin	52.00
Aluminum, No. 12, producers	18.00 to 22.00
Aluminum, No. 12 (Standard)	15.00
Lead, New York	5.75
Antimony, New York	7.75 to 7.80
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.35

We Recommend a *Heroult* ELECTRIC FURNACE to Meet Your Requirements

American Bridge Company designs and constructs electric furnaces for all standard requirements and is prepared to make special designs to answer special needs. Capacities, ½ ton to 100 tons, open-top, chute, machine, or hand charging. Basic or acid operation. Extra sturdy construction for turning out superior gray iron, steel, and other ferrous materials—particularly adapted for stainless irons and stainless steels. High-powered transformers and multiple voltage control give maximum efficiency and keep down costs of operation.



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One ton of Globe shot in most cases will convince you that shot-blasting is the low-cost way to clean castings, whether grey iron, malleable or steel.

Write us for samples and data that *shows* you why Globe Shot will save you money.

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New Trade Publications

AIR HOISTS—Ingersoll-Rand Co., 11 Broadway, New York, has issued a new bulletin on its line of air hoists. Information is presented on both its single drum and double drum air hoists. Single drum hoists are available in sizes with capacities up to 2000 pounds straight pull and double drum hoists are built in four sizes up to 2000 pounds capacity at various rope speeds.

PLATING—An operating manual for copper, brass, bronze and zinc plating with copper and zinc cyanides has been prepared by the technical staff of the R. & H. chemical department, duPont de Nemours & Co., Wilmington, Del. This manual presents information on specifications and methods of using copper and zinc cyanide. Sections are devoted to instruction on making the plating solution, operating, analyzing solution and cleaning the metal prior to plating.

POWER TRANSMISSION—American Leather Belting association, 41 Park Row, New York, recently has published a book by Robert Drake, entitled "50 Reports on the Mechanical Transmission of Power From Motor Drive to Industry." The publication covers practical plant application operation, and maintenance of all kinds of motor drives, including multiple V belts, belting, chains and gears. The book, which contains 224 pages, covers the entire subject of individual motor drives and modern group drives, showing that some combination of both systems are needed in most plants and what cost savings can be effected.

COUPLINGS — The Falk Corp., Milwaukee, recently has published a folder on its 4-duty coupling. The unit is designed in particular for use where starting conditions are severe or unusual or where mechanical protection is needed against overload. Illustrations show the design of the unit as well as the application.

POTENTIOMETER—C. J. Tagliabue Mfg. Co., Park and Nostrand avenues, Brooklyn, N. Y., recently has published a bulletin dealing with its photo-electrically balanced recording potentiometer. Drawings show the construction and information is presented on the operating features.

LOCOMOTIVES — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a bulletin on the construction, operation, and application of its diesel-electric locomotives. The company also has prepared an illustrated leaflet discussing quiet operating induction motors.

COMPRESSORS—A portable compressor unit is described and illustrated in a folder recently distributed by the Worthington Pump & Machinery Corp., Harrison, N. J. The company also has prepared a bulletin on its monobloc centrifugal pumps.

CABLE—The General Electric Co., Schenectady, N. Y., recently has issued a booklet entitled "How to Select Insulated Cable" which provides a reference book on insulated cable for the transmission and distribution of electric power at normal frequencies. The company also has prepared a bulletin entitled "Summer Cooling and Year 'Round Air Conditioning for Profit and Comfort."

LININGS—Patterson Foundry & Machine Co., East Liverpool, O., has prepared a bulletin illustrating and describing its line of acid resistant lining blocks and cement. Primarily this material is resistant to any chemical action from direct or gaseous contact with various acids.

CONVEYORS—Link-Belt Co., 910 South Michigan avenue, Chicago, has issued a general catalog covering its line of products including elevating and conveying chains, elevator buckets, sprocket wheels, chain drives, power transmission machinery, positive variable speed transmission units, standardized bucket elevators, apron conveyors, screw conveyors, belt conveyors, bucket elevators and conveyors, flight conveyors, etc.

BAKELITE SYNTHETIC RESINS—Bakelite Corp., Bound Brook, N. J., has published a small booklet on the development of synthetic resins for paints and varnishes. Tests on these materials have led to their introduction in a wide range of service where extreme durability and resistance to abrasion is required.

WELDING—Hobart Brothers Co., Troy, O., has published a booklet on "Electric Arc Welding," presenting information concerning the process which will assist in the successful application of that equipment to practical work. Information includes the equipment used, types of welds, weldability of metals, choice of electrodes and operating instructions.

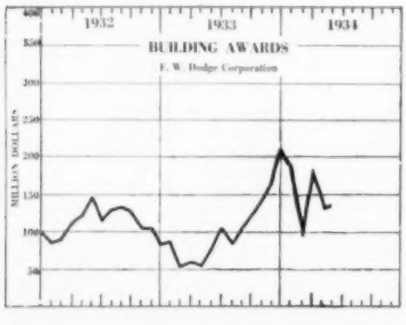
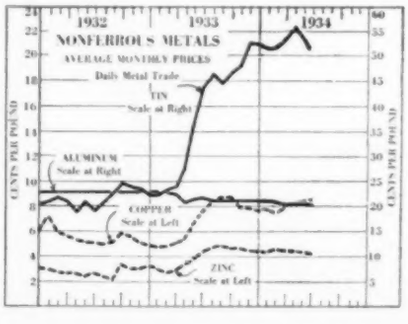
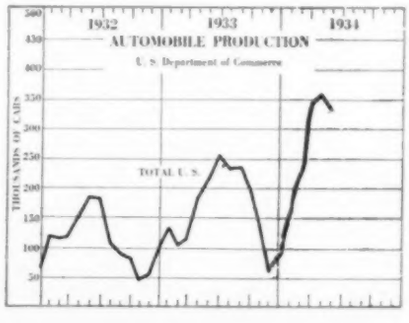
CIRCUIT BREAKERS — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a catalog on its line of small oil circuit breakers. Included are tables which give the proper type of breaker, indoor, outdoor or subway, for any kilovolt-ampere needed.

ALLOY STEEL—American Manganese Steel Co., 6600 Ridge avenue, St. Louis, has published a folder on its special series of cast nickel-chromium alloys made for resisting heat, corrosion or acids. The publication includes a view of the plant, interior views showing equipment and methods, and photographs of numerous types of castings produced.

COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has published several bulletins dealing with its line of compressors and pumps. Specifically, the bulletins describe small air compressor units, refrigeration compressors, rotary pumps, and vertical triplex single acting power pumps.

AERATER—Beardsley & Piper Co., 2541 North Keeler avenue, Chicago, has published a bulletin on its new equipment for screening, aerating and piling molding sand. The machine has a screen, and a rotor driven through a 1½-horsepower motor.

GRINDERS—Norton Co., Worcester, Mass., has published two bulletins, one devoted to "A Convenient Tool Room Grinder" and the second to "A Small, Handy Surface Grinder." Information is presented on design and use.

Faked Foundry Facts

Centrifugal Casting